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THESIS

A SIMULATION MODEL OF ISSUE PROCESSING AT NAVAL
SUPPLY DEPOT YOKOSUKA, JAPAN

by

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A Simulation Model of Issue Processing
at
Naval Supply Depot Yokosuka, Japan

by

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ABSTRACT

A computer simulation program has been written in IBM's GPSS V to model the issue processing functions of U.S. Naval Supply Depot Yokosuka, Japan. The results of simulation experiments that may be conducted with the model can be used by analysts in the Planning Division of the Naval Supply Depot to predict actual Depot performance under conditions of surge demand.

TABLE OF CONTENTS

I.	INTRODUCTION	7
	A. THE PROBLEM	7
	B. THESIS OBJECTIVE	9
	C. SCOPE	9
	D. LIMITATIONS	10
	1. Data Collection	10
	2. Microcomputer Simulation	10
	E. ORGANIZATION OF THESIS	11
II.	MODELING TECHNIQUES	12
	A. OPERATION RESEARCH	12
	B. SIMULATION	13
	C. SIMULATION LANGUAGES	16
	D. GPSS	18
III.	THE SYSTEM TO BE MODELED	21
IV.	THE MODEL	27
	A. DEFINITION	27
	B. STRUCTURE	28
	1. Requisition Generation	29
	2. Work Scheduling	31
	3. Workcenter Operations	32
	4. Requisition Flow Control	33
	5. Printer Operations	35
	6. Transportation Operations	35
	7. Duty Section Operations	37
V.	VERIFICATION AND VALIDATION	40
	A. INTRODUCTION	40
	B. VERIFICATION	43

C.	VALIDATION	44
VI.	EXPERIMENTATION	47
VII.	SUMMARY	51
A.	CONCLUSIONS	51
	1. Discrete Event Simulation Using GPSS V . .	51
	2. Discrete Event Simulation Using GPSS/PC	51
B.	RECOMMENDATIONS	51
	1. Data Collection	51
	2. Model Experimentation	52
	3. Microcomputer Implementation of the Model	52
APPENDIX A:	PROGRAM LISTING	53
APPENDIX B:	GPSS BLOCK DIAGRAM	99
APPENDIX C:	PROGRAM OUTPUT	125
LIST OF REFERENCES	136
BIBLIOGRAPHY	137
INITIAL DISTRIBUTION LIST	138

LIST OF FIGURES

3.1	Physical Layout	22
3.2	Flow Diagram	24

I. INTRODUCTION

A. THE PROBLEM

The U.S. Naval Supply Depot Yokosuka, Japan (NSD Yokosuka), is tasked with providing logistics support to U.S. Navy fleet units and shore activities in the Japan and Northern Pacific operating areas. As the major U.S. Navy logistics installation in Japan, NSD Yokosuka is the primary source of logistics support for all Navy and Marine Corps shore activities based in Japan. Fleet units supported by NSD Yokosuka include eleven homeported ships as well as deployed ships of the Seventh Fleet. Although NSD Yokosuka's major function is material support, it also provides essential supply services. The Freight Terminal Division is responsible for transshipment to the requisitioner of issue priority group one material received from stateside Naval Supply Centers and Defense Logistics Agency (DLA) activities. The Depot also manages a variety of other support services including contracting, data processing, accounting, disbursing and personal property shipment.

In addition to its basic fleet support role, NSD Yokosuka is tasked with tri-service support responsibilities for fuel and subsistence. NSD Yokosuka is the DLA Designated Specialized Support Point for provisions in Japan, providing subsistence support to all fleet units, DoD commissaries and troops in the Japan operating area. As the DLA agent for fuel, NSD Yokosuka operates the largest fuel complex in the Pacific. The Fuel Department provides bulk petroleum products to all military activities in the Western Pacific and maintains Prepositioned War Reserve Stock (PWRS) inventory levels to meet the anticipated combined requirements of the services in that area.

NSD Yokosuka is strategically positioned to support contingency operations in the Far East. Any conflict in the Northern Pacific, Korea, or other Southeast Asian country requiring extensive deployment of ships, aircraft and troops will result in a surge of activity for NSD Yokosuka. If the conflict is not short-term in duration, the increased operating tempo could be expected to result in new manpower requirements, multi-shift operation of the NSD and its detachments, possible expansion of physical storage facilities and the acquisition of additional material handling equipment. NSD Yokosuka's ability to respond to a surge in demand for logistics support brought about by a period of increased tension or open conflict is a critical issue to planning military operations in the Far Eastern theater. The NSD's effectiveness in this type of scenario hinges on its ability to escalate operations in a short time frame. Counter to the rapid response required of NSD Yokosuka in a contingency situation is the relative difficulty of mobilizing the necessary manpower and other resources on short notice. Planning specific requirements in advance and identifying sources to fill those needs is essential to maintaining supply readiness at NSD Yokosuka.

Predicting future resource requirements of the Depot is a primary function of the Planning and Comptroller Department, more specifically, the Planning Division. In any operating environment, NSD Yokosuka seeks to minimize the processing time associated with issuing material to customers while maximizing the availability of other support services required. To this end, the Planning Division projects the volume of demand that the Depot will be expected to support in various operational scenarios, i.e., positioning of an additional carrier battle group or a build-up in troop levels. Divisional requirements in support of those levels of operation are estimated. The

consolidated requirements of the Depot are quantified and plans outlining the allocation of resources among divisions are formulated.

B. THESIS OBJECTIVE

The objective of this thesis is to provide a predictive and quantitative tool to support the contingency planning efforts of NSD Yokosuka. A computer program modeling the issue processing functions of the Depot will be constructed. The program will be written in IBM's General Purpose Simulation System V (GPSS V). The completed program may be used to conduct experiments simulating Depot performance under conditions of surge demand. The information gathered in a controlled series of experiments with the model can be used to help formulate operating policy and resource distribution plans to cope with contingency situations.

C. SCOPE

The scope of the model will be limited to those functions of NSD Yokosuka in direct support of issue processing operations, from requisition receipt to the point of availability of the issue for shipment to the requisitioner (or the point of actual delivery to the requisitioner in the case of bearer walkthroughs, quick picks and issues delivered to Naval Base Yokosuka activities by NSD tractor trains). A detailed list of the actual processes to be simulated is provided in Chapter IV. Other Depot operations have been excluded for the following reasons:

1. The complexity of a model can be expected to increase as the scope of the system to be simulated is expanded. Limiting the scope of the system to main-stream issue processing functions will provide important information to analysts while keeping model modification and experimentation within the capability of personnel without extensive simulation experience.
2. The scope of the system to be simulated is also limited by the capabilities of the software and hardware on which it is implemented. The memory requirements of a program written to simulate all major functions of the Depot would exceed the maximum amount of memory addressable by GPSS V.

3. Model design and validation imposes substantial data collection responsibilities on the NSD Planning Division. Depot personnel resources were taxed to meet the data requirements imposed during development of the model of issue processing functions.
4. Some functions of the Depot are sufficiently complex to form the basis of major simulation projects by themselves. Inventory Control Department, Data Processing Service Center (DPSC) and Freight Terminal Division operations are all candidates for separate simulation projects.
5. Not all systems can be simulated with discrete simulation methods. The Fuel Department manages several processes that are best modeled by continuous simulation methods.

D. LIMITATIONS

1. Data Collection

Construction and validation of the model was hampered by difficulties experienced by the author during data collection. Due to the physical separation of NSD Yokosuka from the Naval Postgraduate School, the data collection effort was managed by the NSD Planning Division. Personnel from cognizant divisions of the Depot were tasked with collecting the data from retained records or by observation of the physical processes. The time-intensive nature of random sampling slowed the process of data collection. This was aggravated by competing operational requirements in the Inventory Control and Material Departments. At the time of this writing, the collection of service time samples for the Packing Section and half of the material storage areas remained incomplete.

2. Microcomputer Simulation

The initial objective of this thesis was to model NSD issue processing operations on a microcomputer. Efforts in that direction were blocked by the memory requirements of

the program. The technical details of this limitation are discussed briefly in Chapter II of the thesis.

E. ORGANIZATION OF THESIS

The balance of this thesis is devoted to the examination of simulation as a logistics planning tool and to the development and validation of a program to be used for simulation experimentation. In Chapter II, the suitability of simulation and other operations research disciplines to supporting logistics planning efforts is reviewed. A description of issue processing at NSD Yokosuka, the system to be modeled, forms the basis of Chapter III. Chapter IV utilizes GPSS block diagrams to explain the simulation program structure. Program verification and a discussion of program validation are presented in Chapter V. Guidance in experimentation techniques and a discussion of simulation experiments conducted by the author are included in Chapter VI. Recommendations and conclusions in Chapter VII will address further simulation experimentation and the observed benefits of simulation in supporting logistics planners.

II. MODELING TECHNIQUES

A. OPERATION RESEARCH

NSD Yokosuka's ability to provide the level of logistics support required by DoD activities in the Japan operating area is a product of the combined efforts of several work-centers. The DPSC Department and the Customer Services, Requirements, Storage, Labor and Equipment and Freight Terminal Divisions all perform tasks integral to the processing of requisitions received by NSD Yokosuka. Because a decision made in one division may affect the operations of another, the performance of individual divisions must be evaluated in terms of their contribution to overall Depot performance. This interaction between functional areas must be taken into account by the Planning Division during the formulation of operating strategies for surge demand environments. Operations research techniques incorporate the systems approach and can serve as an important logistics planning tool.

Operations research is a collection of mathematical tools that may be applied to solve practical decision problems within a system [Ref. 1]. The aim of operations research analysis is to evaluate the probable consequences of decision choices. These choices are typically concerned with the allocation of scarce resources within the system. Most methods of operations research use models to study the actual system [Ref. 2: p. 4]. Models represent objects of interest within the system as entities, the characteristics of entities as attributes and the interactions causing change within the system as activities. Models are employed when experimentation with the actual system is not a practical approach to analyzing operations. Accordingly, formulation of a model is a suitable method of predicting the

performance of a supply depot under conditions of surge demand.

Specialized operations research techniques have evolved to handle certain well-defined classes of systems problems. Network analysis may be used to solve transportation problems. Inventory algorithms are used to make inventory control decisions. These techniques are well suited to narrowly-defined problems and are regularly employed by the military to solve logistics problems. The study of broader, less well-defined systems require more generalized mathematical techniques.

Mathematical analysis is applied to systems management problems by representing attributes of the system as variables and activities as mathematical functions that interrelate the variables [Ref. 3: pp. 8-9]. Mathematical analysis is a sophisticated operations research technique that can be used only by analysts with extensive backgrounds in mathematics. It is not always possible to formulate a complete mathematical model of a complex system. The combined effects of uncertainty, dynamic interaction between decisions, interdependency among variables and the representation of processes over long time horizons are difficult to represent mathematically and may require alternative methods of research [Ref. 4: p. 142]. Stock point analysis problems fall into this category. The stochastic nature of requisition arrival and processing times, overlap between the operations of separate divisions within a supply depot, the relationship of requisition priority and type to the processing procedures followed and the need to observe operations over extended periods of time all support the use of computer simulation as a research tool.

B. SIMULATION

Simulation is the process of designing a model that duplicates the dynamic behavior of the essential

characteristics of a system for the purpose of studying that system [Ref. 5]. It is a popular technique among operations research practitioners. In a survey by Weston [Ref. 6] of 1000 U. S. firms, it was the most frequently employed quantitative tool. Simulation is also used extensively by the military to evaluate weapons and logistics systems. Because the structure of a simulation model bears a close relation to the logical structure of the real system, model development is simplified. Schmidt [Ref. 7] notes that the level of mathematical sophistication required to develop a simulation model of a complex system is generally less extensive than that required to develop a mathematical model, underscoring simulation's relative ease of use. It is this simplicity that makes simulation intuitively popular to analysts.

Simulation is a versatile operations research technique. It may be used as a descriptive tool (to describe a current system) or as a predictive tool (to explore a hypothetical system or design improvements to a current system). Simulation is also flexible with respect to changes in the actual system. Variables can be modified before a simulation is run, or dynamically, to align the model with real system conditions.

There are drawbacks to the use of simulation. Simulation does not optimize in the sense that calculus-based analytical methods do [Ref. 3: p. 38]. Optimal solutions may be obtained only through repetition of simulation experiments. Simulation models produce less precise results than does mathematical analysis [Ref. 2: p. 13]. Due to the probabilistic nature of simulation, the results of simulation experiments repeated in succession can be expected to vary and the sensitivity of a simulation model to changes in the value of input variables is not subject to exact measurement. Simulation models experience the same problems as

models employed in other techniques of operations research. They may appear to accurately reflect the real system, when in fact, they do not. Simulation models, as all others, will yield incorrect results if they are not validated carefully.

There are two major types of simulation, continuous and discrete [Ref. 4: p. 143]. Continuous simulation is concerned with systems that change continuously with respect to time and with measurements that are not restricted to integers. Refinery operations and rocket trajectories are examples of systems that are studied by the use of continuous simulation. In discrete simulation, the simulated time advances in a stepwise discrete fashion. A discrete simulation is time-oriented if the simulation clock is updated at regular time intervals. If the clock is updated by the scheduled occurrence of events, the simulation is termed event-oriented. Discrete event simulation lends itself especially well to the modeling of queuing systems and, therefore, is generally applicable to modeling the performance of service organizations that can be represented as a collection of service facilities and queues [Ref. 8].

Discrete event simulation is frequently used to model military supply depot operations. The use of discrete event simulation as a forecasting tool offers several advantages to logistics planners. Queue statistics gathered during the simulation pinpoint processing bottlenecks that may be expected to occur. Server utilization statistics collected for each functional area may be used to support resource allocation decisions. System throughput data can be quantified by measuring the processing time for the different classes of requisitions passing through the system. In addition, the model may be easily modified to reflect increasing levels of demand, changes in net effectiveness or the addition of personnel.

C. SIMULATION LANGUAGES

Discrete event simulation programs may be written in a general purpose programming language like FORTRAN or PASCAL, or in a special purpose simulation language. As computer simulation evolved as an operations research technique in the late 1950s, all simulations were written in general purpose or specific-machine languages. As researchers began to recognize the fact that many situations being simulated were composed of functionally similar processes, the need to develop special purpose languages in which single operators would perform common functions became apparent. Emshoff and Sisson [Ref. 9: p. 116] enumerated the functions common to all simulations that distinguish simulation languages from general purpose programming languages:

1. create random numbers
2. create random variates
3. advance time, either by one unit or to the next event
4. record data for output
5. perform statistical analyses on recorded data
6. arrange outputs in specified formats
7. detect and report logical inconsistencies and other error conditions

Kiviat [Ref. 10] cited programming convenience and concept articulation as the two major advantages of using a simulation language as opposed to a general purpose language.

Concept articulation refers to the ability of simulation languages to communicate the structure of a system being modeled through the use of a descriptive vocabulary. This is especially important to analysts in the model development phase. It also improves communication in that simulations are more easily explained to management and other non-programming oriented users.

The programming convenience of simulation languages is evidenced by the reduction in both program length and

development effort required. Jennergren [Ref. 11] concluded that simulation programs written in PASCAL average twice the length of their simulation language counterparts. Emshoff and Sisson [Ref. 9: p. 117] estimate the savings in model development effort resulting from the use of simulation languages to be on the order of a factor of 10. Several factors contribute to the programming convenience of simulation languages. The subroutines provided as standard features of simulation languages provide programmers with simple tools to represent simulation-unique functions and concepts. The ease with which simulation languages define classes of system entities, differentiate among entities within those classes and permit adjustment of the number or type of entities in the system is also helpful. The convenience of simulation languages is not achieved without sacrifice. The structuring of entities and activities in simulation languages increases their flexibility in that changes to the system require only simple modifications to the program. These generalized structures, however, limit the ability of simulation languages to represent system detail. Though simulation languages automatically collect and display data generally desired by analysts, they are less flexible than general purpose programming languages with respect to the variety of output formats. Finally, programs written in simulation languages can expect to experience slower execution times than general purpose language programs.

The initial concern of most organizations in the process of selecting a simulation language is ensuring that the chosen language is compatible with installed hardware and that its use is within the capability of the organization's analysts. Other questions should be answered in the second phase of the selection process. The relative ease of learning, availability of users manuals, machine

portability, quality of error diagnostics, language efficiency and cost of the languages under consideration should be explored. Finally, the ability of the chosen simulation language to naturally describe the system in question should be studied. The suitability of a simulation language to a given problem may be assessed by examining its "world view."

The world view of a simulation language is the way that it conceptualizes the entities of a system, the attributes that further describe those entities, and the interaction between those entities and the activities of the system [Ref. 12: p. 17]. World views of simulation are grouped into two schools of simulation thought, one emphasizing the use of flowcharts to describe models, the other relying on program statements.

Flowchart languages are regarded by users as somewhat easier to learn and interpret, while statement oriented languages are more flexible [Ref. 12: p. 18]. Statement oriented languages are characterized by three world views--activity, event and process. Flowchart oriented simulation languages adhere to the transaction world view. The transaction world view models systems by tracing the flow of transactions through specialized activity blocks. Simulated time advances as transactions pass through the blocks which are used to represent actual processes or real system decisions. Users familiar with flowcharting techniques and the system being modeled find the transaction view convenient to use and easy to learn. IBM's GPSS is the predominant language in this category.

D. GPSS

The transaction world view of GPSS is structurally similar to the complex queuing problems posed by requisition flow in a supply depot. GPSS uses block diagrams to visualize transactions moving from process to process within the

system. Each GPSS block is implemented by a code segment representing an action relative to the system simulation. The close relationship between the block diagram and program code to the logical structure of the system being simulated makes GPSS easy to use. System throughput, resource utilization and queuing statistics collected as standard features of GPSS may be tailored to support the information requirements of the logistics planner.

GPSS is particularly attractive to the inexperienced user. The block diagram structure reduces the complexity of model development and communicates an understanding of the simulation program to users. Statistics gathering and display require minimal effort on the part of the user. Because GPSS is the most popular and widely used simulation language [Ref. 13], numerous companies market GPSS products and provide comprehensive documentation. In addition several academic texts on GPSS have been published, offering another source of information to users.

Minuteman Software has developed a microcomputer version of GPSS, marketed under the name of GPSS/PC, to take advantage of the increased CPU and memory capacities of modern microcomputers. Designed for use on IBM compatible microcomputers, the structure and syntax of GPSS/PC are nearly identical to that of the mainframe version, enabling it to retain its attractiveness as a discrete event simulation language. The primary advantages of using a simulation language designed for the microcomputer are reduced software expenses and the convenience to the analyst of working on a dedicated microcomputer. While the general design of GPSS/PC is suited to the simulation of supply depot operations, it is constrained by its inability to address more than 640 kilobytes of random access memory, a limit shared by all applications programs running on IBM's Disk Operating System (DOS). Due to this inherited limitation, GPSS/PC is not

useful in the simulation of large queuing systems such as NSD Yokosuka.

Discrete event simulation, utilizing GPSS, could be effectively used to support logistics planning efforts of NSD Yokosuka. Note the following points:

1. Issue processing procedures at NSD Yokosuka are permeated with the type of queuing phenomena that discrete event simulation languages, GPSS in particular, are designed to model.
2. The standard format of discrete simulation output is suited to the information requirements of Depot planners.
3. Experimentation, including minor modifications, with existing simulation models is within the capability of analysts in the NSD Yokosuka Planning Division.
4. The block diagram structure of GPSS improves user understanding of program structure, easing the process of making program modifications required by changes in NSD facilities or procedures.
5. Owing to its popularity, GPSS documentation, training, and technical assistance are all readily available to the NSD.

While discrete event simulation can be a useful tool to logistics planners, its disadvantages must also be recognized. Drawbacks to the use of computer simulation in logistics planning include:

1. Validating a simulation model requires substantial effort and is a continuing process as the model must be maintained to reflect real system changes. If the basic model does not accurately reflect actual system operations or supporting data is erroneous, simulation results will not be useful.
2. Though experimentation and minor modifications are within the capability of NSD Yokosuka personnel, major revision would require outside training or assistance.
3. Because the simulation model is a simplification of the actual system, detail useful to planners is lost. In addition, limiting the scope of the model leaves planners without information on other essential Depot functions.

The practical limitations of discrete event simulation must be accepted before it is employed as a logistics planning tool. In combination with other operations research techniques, discrete event simulation using GPSS can be an effective method of forecasting NSD Yokosuka performance under conditions of surge demand.

III. THE SYSTEM TO BE MODELED

NSD Yokosuka's main administrative offices and storage facilities are located on U. S. Naval Base Yokosuka, of which the NSD is a tenant activity. Figure 3.1 shows the physical layout of NSD facilities on Naval Base Yokosuka. Yokohama Cold Storage, located approximately 20 miles from Yokosuka, is the only modeled activity of the NSD not located within the confines of Naval Base Yokosuka.

NSD Yokosuka has 54 U. S. Civil Service and 905 Japanese National employees in addition to the 176 military personnel authorized. Normal working hours are 0800 to 1645 Monday through Friday with a 45 minute lunch break. Non-duty hour processing of issue priority group one (IPG1) requisitions and IPG2 bearer walkthrough and Casualty Reporting System (CASREPT) requisitions is handled by the duty section on weekends and by the Customer Services Division evening and midnight shifts during the week. DPSC maintains seven day a week, around-the-clock computer center operations in support of issue processing.

The Depot receives an average of 43,000 requisitions a month, of which approximately 90% are for standard stock items. Of the total demand for standard stock items, NSD Yokosuka typically makes 30,000 issues per month from its \$43,000,000 inventory of over 78,000 line items. 75% of those issues are for material stored in the general storage locations of the Depot. The remaining 25% are for provisions stored in Yokosuka Cold Storage (Building 1390), Yokosuka Dry Storage (B-47) and Yokohama Cold Storage.

Figure 3.2 is a basic flow diagram of NSD Yokosuka issue operations. Requisition input to the system arrives in two forms, hard copy or online. Online requisitions are received via Automatic Digital Network (AUTODIN), Disk

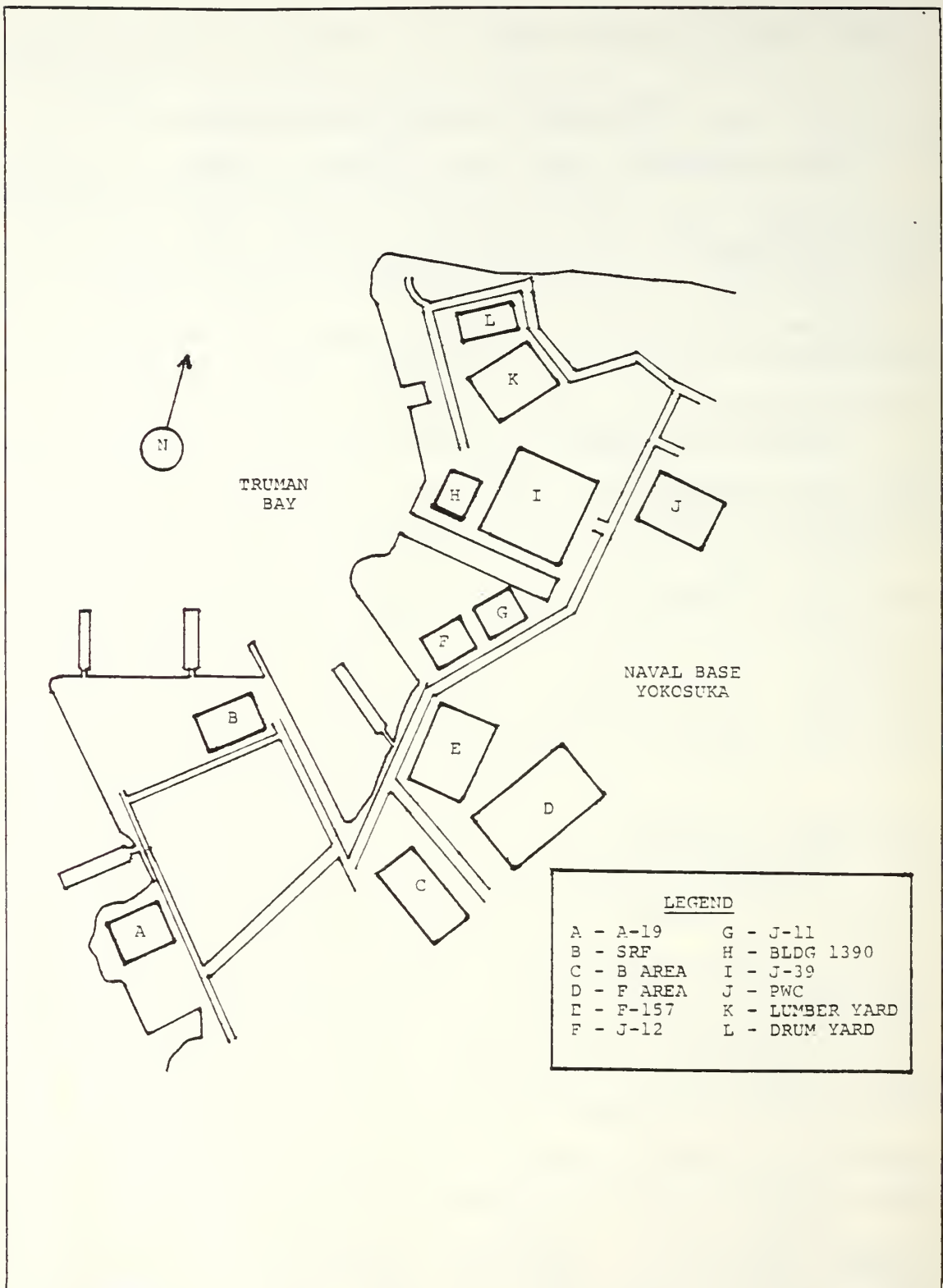


Figure 3.1 Physical Layout.

Oriented Supply System (DOSS) and local customer remote terminal entry. The requirements of activities without installed remote terminal entry equipment and all perishable provisions (9MP/9MB), ships store stock (1Q) and bearer requisitions are received in hard copy form. Requisitions for 9MP, 9MB and 1Q material are initially routed to the Requirements Division for stock check. IPG1 requisitions, IPG2 bearer walkthrough, CASREPT and quick pick requisitions and all 9MP, 9MB and 1Q requisitions (regardless of priority) received by NSD are entered via remote terminal in Customer Services. All other requisitions are transferred to DPSC for entry. Requisitions are handled throughout the Depot on a first come, first served, within priority level basis. Priority levels, from highest to lowest, are as follows:

1. IPG1 bearer walkthrough all other IPG1
2. IPG2 bearer walkthrough
3. IPG2 CASREPT (not bearer walkthrough)
4. IPG2 quick pick
5. all other IPG2
6. all IPG3

Regardless of their origin, all IPG1, CASREPT, bearer walkthrough, quick pick, dry provisions (9MP) and 1Q requisitions wait in a queue file to be processed by Uniform Automated Data Processing System (UADPS) programs UC02 and UC96. The queue file is emptied frequently (every 5 minutes) into UC02/UC96 for processing. Issue documents for material determined to be in stock are output immediately in Customer Services. 9MP and 9MB requisitions are entered under local procedures and issue documents are printed on the Customer Services printer. The balance of IPG2 and all IPG3 requisitions are processed in batch mode by UC02/UC96 and local programs LC06, LC07 and LC08. Issue documents for material determined to be in stock are output in Storage Control.

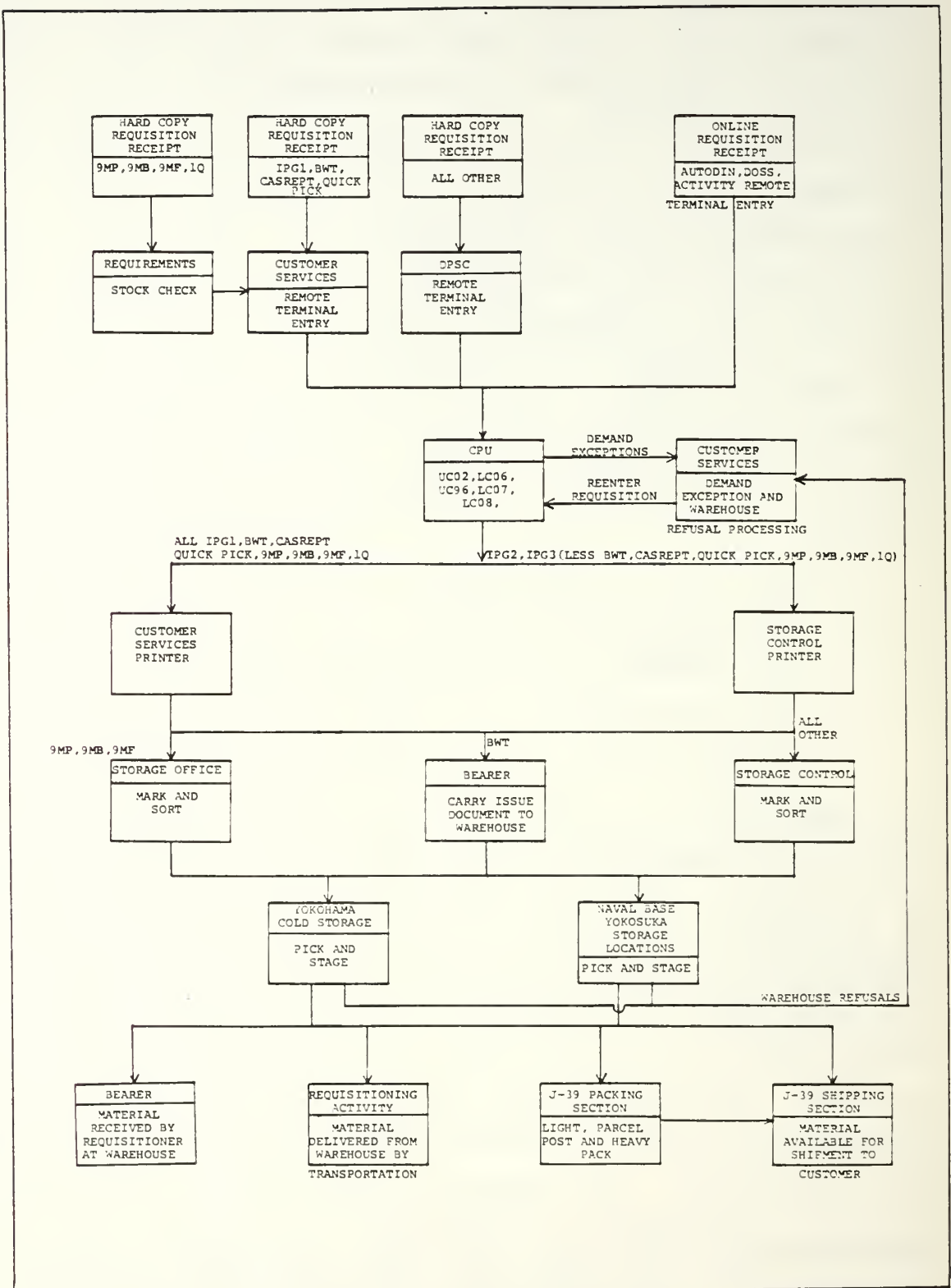


Figure 3.2 Flow Diagram.

Issue documents for provisions are output in Customer Services. Demand exceptions are reviewed by exception clerks in Customer Services and re-entered into the system.

All issue documents printed in Customer Services are annotated or stamped as appropriate (quick pick, CASREPT, etc.) and are routed for further processing. Provisions issue documents are delivered to the Storage Office. Issue documents produced for bearer walkthrough requisitions are released to the bearer to be hand carried to the warehouse storing the material. All other issue documents are delivered to Storage Control.

Storage Control personnel sort those issue documents printed by the Storage Control printer and those received from Customer Services by warehouse and deliver the document batches by bicycle messenger to their respective storage locations. Provisions documents received in the Storage Office are also sorted by storage location. Issue documents for provisions in Building 1390 and B-47 are delivered by the bicycle messenger. Issue documents for perishable provisions stocked in Yokohama are delivered by a truck that leaves Yokosuka at 0900 on workdays, arriving in Yokohama later the same morning.

Upon receipt of issue documents, warehouse personnel pick the requisitioned material, attach copies of the issue document, and segregate it by destination. In general storage locations, material is staged separately for delivery to the Publics Works Center (PWC), the Ship Repair Facility (SRF) and the Packing and Shipping Sections of the Freight Terminal. In provisions warehouses, the majority of material is staged within the facility to be delivered directly to the requisitioner. Provisions issues for off-base delivery or bearer pick-up are staged separately. All bearer issues are turned over to the customer at the warehouse. Warehouse refusals are annotated as such on issue

documents which are returned to Customer Services for processing (i.e. investigation, transaction reversal, referral or cancellation).

Material segregated for delivery in general storage locations to PWC, SRF, or the Freight Terminal is transported by Labor and Equipment Division tractor trains to its next destination. Tractor trains run on two separate routes at 0815, 1015, 1300 and 1400 on workdays. Material requisitioned by PWC and SRF is delivered enroute to Building J-39. All material requiring packing prior to shipment is unloaded in the Packing Section of J-39. The remaining material is delivered to the Shipping Section. Tractor trains run on an as required basis to deliver provisions from B-47 and Building 1390 to the Freight Terminal.

Material transported to the Packing Section is packaged for further transportation to the customer. Three basic types of pack are used--light, parcel post or heavy--as appropriate to the material. When packing is completed the material is delivered to the Shipping Section, adjacent to the end of the packing line, for further processing.

The Uniform Material Movement and Issue Priority System (UMMIPS) treats issues received in the Shipping Section as available for shipment to the requisitioner and issue processing statistics maintained by the Depot do not record handling time in the Shipping Section. Shipping Section operations, beyond receipt of material, are not modeled in the simulation program.

IV. THE MODEL

A. DEFINITION

The computer program is written in IBM's GPSS V. The program simulates all NSD Yokosuka functions that directly support issue processing operations, from requisition receipt to the point of availability of the issue for shipment to the requisitioner. Specific functions simulated are:

1. Requirements Division stock check of perishable provision and ships store stock requisitions.
2. Customer Services and DPSC remote terminal entry of hard copy requisitions.
3. Customer Services demand exception and warehouse refusal processing
4. Customer Services and Storage Control issue document printer operations
5. Storage Control and Storage Office sorting and handling of issue documents
6. Delivery of issue documents to Yokohama Cold Storage and Naval Base Yokosuka storage locations
7. Warehouse pick and stage operations (and shipment preparations in provisions storage locations)
8. Tractor train delivery of issues to SRF, PWC and the packing and shipping sections of the Freight Terminal
9. Packing operations
10. Duty section and late shift operations

A copy of the program code is provided as Appendix A. Listings of program variables, functions, transaction parameters and storages referenced during the simulation are all included in the program code. A GPSS block diagram of the program structure is provided as Appendix B. The succeeding section refers to segments of the GPSS block diagram to relate the structure of the simulation program to actual Depot operations.

B. STRUCTURE

GPSS simulates actual system performance by generating requisitions (referred to as transactions) at time intervals modeled after real system arrivals and permitting the generated transactions to proceed through block paths representing real system processes. Each GPSS block executes a subroutine which may delay, modify, remove or control the flow of the entering transaction. In a large system composed of separate workcenters, such as NSD Yokosuka, transactions move through a varied series of processes before an issue results. Although these processes differ physically, many are logically similar (e.g., transactions enter a workcenter, wait for service, are processed and then leave the workcenter for the next processing step). Consequently, GPSS is able to simulate a wide variety of processes with a relatively small vocabulary of blocks.

GPSS can also generate control transactions in separate modules to alter system status (i.e., control storage availability, trigger scheduled events). The generation of control transactions and their flow through the program blocks is timed to coincide with operating schedules of the Depot. Time is divided into units of .01 hours in the simulation. The reader is therefore reminded to carefully interpret simulation time in the program (i.e., 30 minutes is represented as 50, 8 hours and 45 minutes as 875, etc.).

This section of the chapter groups logically similar processes into categories and references modules in the GPSS block diagram in Appendix B to demonstrate how actual processes are modeled in the program. All GPSS blocks discussed in this section appear in upper case to set them apart from the text. Assumptions made in modeling the real system processes are presented as are special programming details that may not be apparent to the user. An understanding of this section will improve the reader's

comprehension of the program code. It will also serve to assist the user in making program changes for the purpose of system experimentation or reflecting real system changes.

1. Requisition Generation

Requisition generation and priority assignment is modeled in the requisition generation module of the program. GPSS V limits each model to 32,767 concurrently active transactions. To remain within that limitation during simulation experiments, the number of transactions generated has been reduced by structuring the program to permit a single transaction to represent three requisitions. All succeeding program modules, with the exception of the duty section module, process each transaction as if it were 3 separate requisitions to maintain an operational pace equivalent to actual Depot operations.

The number of demands generated in one week of simulated time is computed by multiplying the monthly demand level input by the user by a factor of .231 (based on an average of 4.33 weeks per month). The daily distribution of those demands is determined by function ETHNN which is derived from daily demand data supplied by the NSD. The daily demand level is then divided by 3 to obtain the number of transactions generated during each simulated day.

Daily requisition arrival rates utilized in the simulation are constant over the weekend, but are computed to force generation of 89% of weekday demands during normal operating hours, consistent with the pattern of workday requisition arrivals actually experienced by the Depot. As data supporting an alternative distribution of requisition arrivals is not available at this time, transactions are allowed to proceed into the model at a uniform rate. Although the clumping of requisition arrivals expected during actual operation is not duplicated, requisition flow similar to that experienced by the NSD is restored early in

the requisition processing cycle by the simulation of the batch printing of issues documents in the printer queue handling module.

The first three requisition generation subsections of the requisition generation module are responsible for generating requisitions on weekdays--before, during and after normal operating hours respectively. The fourth requisition generation subsection generates weekend arrivals. The GENERATE block in each subsection creates a single transaction each simulated day at the beginning of its assigned time period (i.e., 0001 for the AM subsection, 0800 for the operating hours subsection). Because all of the requisition generation subsections create a single transaction each day of the week, transactions generated in the weekday generation subsections must be terminated on weekends and transactions generated in the weekend generation subsection must be terminated on weekdays. The TEST blocks permits the generated transaction to proceed on workdays in the first three subsections and on weekends in the last subsection. Transactions failing that test are transferred to the TERMINATE block labeled RQTRM and removed from the model.

All transactions that are not terminated continue through the requisition generation subsections. The SPLIT and ADVANCE blocks combine to transform the previously generated single transactions into a uniform flow of transactions representing the arrival of requisitions at the NSD. Transactions entering the SPLIT block are split into the number of transactions expected during the period. The ADVANCE block then permits the newly created transactions to pass to the next block at a uniform rate, where they are transferred to the ASSIGN block PRIAS. The ASSIGN block references function FONE and stochastically assigns an integer value representing requisition priority to parameter 1 of each transaction. The following PRIORITY block copies

the parameter 1 value to assign transaction priorities referenced during program execution to determine processing order. All transactions are then routed by their parameter 1 value through a path of SAVEVALUE blocks that serve as requisition counters.

2. Work Scheduling

Operating schedules for Depot workcenters during the normal workday, the late shift and duty section, the issue document printers and the tractor trains are all managed by control transactions in schedule control sections. With the exception of normal workday scheduling, which is controlled in separate modules, all schedule control sections are located in the module whose operations they control.

As an example of how work scheduling is managed by the program, the schedule control section of the duty section module is explained below. The first block in the section generates a control transaction at the beginning of each day. On weekdays the control transaction proceeds through the module, alternately entering ADVANCE blocks to simulate the passage of time and UNLINK blocks positioned to coordinate the flow of transactions with the operating status of the duty section. After 1675 time units have passed, marking the end of the normal workday at 1645, the control transaction is terminated and the process is repeated at the beginning of the next simulated day. On weekends the control transaction is routed directly to the TERMINATE block labeled DTEND and removed from the model, permitting the duty section to remain in continuous operation over the weekend. Scheduling of the issue document printer and tractor train operations differ only in that control transactions are created at more frequent intervals during the day to trigger the repetitively scheduled processes.

3. Workcenter Operations

NSD workcenters supporting issue processing operations are represented throughout the program as storages. A storage is an entity provided by GPSS to simulate homogenous parallel servers, that is, personnel working side by side performing similar duties at similar rates of speed. Each storage referenced in the simulation is included in the storage definition section where its symbolic name, capacity and description is provided. Storages that have been thus defined may then be referenced in the program to simulate the actual processing of requisitions.

SKCK is the symbolic name of the storage referenced by the requisition receipt module. It simulates the stock check of perishable provision and ships store stock requisitions in the Requirements Division and has a defined capacity of two personnel. Storage references are commonly accompanied by two block pairs, QUEUE/DEPART and ENTER/LEAVE. The function of the QUEUE and DEPART blocks is to collect statistics regarding the time spent by transactions waiting for the storage to become available and related queue data. The ENTER and LEAVE blocks perform the function of controlling access to the ADVANCE block, limiting its current contents to the defined capacity of the storage. After a simulation is run, statistics detailing the time spent waiting for service and the active processing time at each defined storage are presented. See Chapter V for a more detailed description of output statistics.

The time that it takes to process a single transaction in the Requirements Division is simulated in the ADVANCE block labeled SKCK. The ADVANCE block delays each transaction for an explicit period of time equal to the value of the variable V\$SKCKS named in the A operand. In recognition of the fact that each transaction represents 3 requisitions, the service times used in the model are

computed by summing 3 individual service times. Individual service times are drawn from functions containing frequency distributions of service times observed during actual operations at NSD Yokosuka. The service times of workcenters for which frequency distributions were not available to the author are computed from mean service times provided by NSD and are assumed to follow the negative exponential distribution. These included all provisions storage locations and the main warehouse (F-157). Mean service times were also used for all Requirements Division, Customer Services Division, Storage Office and Storage Control requisition and issue document handling processes due to the brief and uniform nature of those functions. Mean service times were not available for packing operations, so Packing Section service times employed in the model were computed by dividing the manhours recorded for each pack type on the NSD Yokosuka Uniform Management Reports by the number of issues packed.

4. Requisition Flow Control

Most modules modeling workcenter operations begin with flow control sections that serve two primary purposes. First, program execution efficiency is improved by placing transactions that are about to attempt entry into a storage on a "user chain" until the storage has available capacity. Managing waiting transactions in this manner frees the computer from continuously scanning each transaction attempting to enter a storage. Secondly, the unlinking of transactions from user chains at the end of the workday provides positive control of high priority requisitions that require transfer to the duty section module for processing after normal operating hours.

Though flow control sections in the program differ slightly in structure, the flow control section in the Requirements Division module is representative of the basic

structure employed throughout the program. The first three TEST blocks following SKCKQ route transactions that have joined the queue. Transactions entering during lunch are transferred to the LINK block labeled SKCKL where they are placed on the user chain SKCKC. Transactions entering outside of the normal workday are transferred to the TEST block SKCKT which routes transactions based on their priority. High priority transactions (those handled by the duty section) are assigned a progress indicator in parameter 3 that marks their stage in processing. They are then removed from the QSKCK queue and are transferred to the duty section module for processing. Low priority requisitions (those not handled by the duty section) are transferred to the advance block labeled SKCKA where they are delayed a single time unit to avoid an endless loop of linking and unlinking. The transactions are then transferred to SKCKL and placed on user chain SKCKC. Those transactions arriving during normal operating hours proceed directly to the ENTER block labeled SKCKE if the storage SKCK has remaining capacity. Otherwise, the transactions are transferred to SKCKL and placed on user chain SKCKC. Those entering during working hours when the storage has no available capacity proceed to the LINK block labeled SKCKL where they are placed on user chain SKCKC.

During normal operating hours one transaction is unlinked from the user chain to enter the storage for each transaction leaving the storage, maintaining full utilization of the storage as long as transactions remain on the user chain. All transactions are unlinked from user chain SKCKC at the end of the workday by a control transaction in the schedule control module so that high priority transactions residing on the user chain may be identified and routed to the duty section module. Low priority requisitions are relinked to user chain SKCKC to await processing during the next scheduled workday.

5. Printer Operations

The NSD Yokosuka issue document printers are currently located in DPSC and Customer Services. However, the modeling of printer operations in the program reflects NSD Yokosuka plans to relocate the DPSC printer to Storage Control in Fiscal Year 1986.

Customer Services printer operations including the schedule control section are modeled in the printer queue handling module. IPG1, IPG2 (CASREPT, quick pick and bearer walkthrough) and all provisions transactions are routed to the block labeled CSPRQ and placed in the QCSPR queue. The LINK block places all transactions on user chain ONE. The transactions are released at simulated time intervals of 5 minutes by the UNLINK block labeled UNLNK in the schedule control section, matching queue file processing procedures followed by UC02/UC96. The "printed" transactions are removed from the QCSPR queue by the DEPART block. They proceed through ENTER and LEAVE blocks referencing the CSPR storage without an intervening advance block because the processing delay actually experienced by requisitions waiting for UC96/UC02 to empty the queue file is simulated by the delay on the user chain.

6. Transportation Operations

Issue processing functions of the Depot include the transportation of issue documents and material between stationary workcenters. The programming technique used to simulate transportation processes involves linking transactions to user chains and using control transactions generated in corresponding schedule control sections to unlink them to succeeding modules. Transportation processes that, in actual operations, are essentially without maximum capacities are modeled as such (e.g., the number of issue documents that may be transported to Yokohama Cold Storage during a single delivery run is essentially unlimited).

Modeling transportation processes with known capacities is more complex.

Operations of the "B" route tractor train are simulated in the tractor train delivery module. Control transactions are created in the schedule control section at simulated times corresponding to the actual train schedule and are transferred to the UNLINK block LOADB on workdays. The loading of IPG1 and IPG2 transactions on the tractor train is managed by LOADB and the succeeding UNLINK blocks in the loading section which release all transactions on the JCF, BCH and ACH user chains to the test block BTEST in the operations section.

The operations section controls transaction access to the tractor trains. BTEST permits IPG1 and IPG2 transactions to proceed to the following TEST block. The weight of each transaction is then checked to ensure that it does not exceed the remaining capacity of the storage BTRN. Transactions meeting that test are transferred to BTRNE to enter the storage (i.e. are loaded on the train), depart QBTRN in the following block and are linked to user chain BTRNC in the succeeding LINK block. All IPG3 transactions and those transactions whose weight exceeds the remaining capacity of the storage (signifying that the train has been loaded to capacity) pass through the following ADVANCE block and are transferred back to their respective warehouse module to await the next train. By screening IPG1 and IPG2 transactions in advance of the normal loading cycle, IPG3 transactions at the first tractor train stop are prevented from effectively denying transportation to IPG1 and IPG2 transactions at later stops. This is consistent with tractor train loading procedures of NSD Yokosuka.

The succeeding blocks in the loading section govern the loading of IPG3 transactions returned to the warehouse. The control transaction passes through an ADVANCE block

which delays it to simulate movement of the tractor train from J-39 to its first stop, J warehouse area. The following UNLINK block releases, in priority order, all transactions waiting on user chain JCH to the TEST block BTRNT. The unlinked transactions are then loaded on the tractor train, capacity permitting, in the manner described by the previous paragraph. The control transaction continues through alternating ADVANCE and UNLINK blocks to repeat this process for transactions waiting at warehouse areas A and B.

After linking waiting transactions to the user chain BTRNC, the control transaction in the loading section enters an ADVANCE block which delays it to simulate movement of the train to the first unloading points, PWC and SRF. When the control transaction enters the succeeding UNLINK block, all transactions on the user chain BTRNC leave the storage BTRN and proceed to the TEST block TMTST. Transactions with a parameter 4 value indicating delivery to PWC and SRF are transferred for termination simulating delivery to requisitioner. All other transactions are delayed by an ADVANCE block to simulate transportation to the Freight Terminal.

7. Duty Section Operations

The flow control sections throughout the program are designed to forward IPG1 and IPG2 CASREPT and bearer walkthrough transactions to the duty section module at the end of the workday and on weekends. Processing steps in the duty section module are similar to normal workday procedures except that all transactions are stock checked before remote terminal entry and transportation delays are modeled to recognize the fact that requisitions handled by the duty section are processed continuously from receipt to issue. Additionally, all 9MP and 9MB issues are made from Building 1390, as nearly all after hours provisions issues made by NSD Yokosuka are for requisitions received from inport ships.

So that transportation delays due to single issue processing by the duty section are accurately modeled, each transaction (representing three requisitions at this point) entering the storage DUTY is split into three identical transactions, each representing a single requisition. The number of transactions that may be simultaneously processed in the duty section module is limited to the duty section storage capacity of 2 which is consistent with the number of personnel actually available in the late shifts and duty section to handle issues.

The storage DUTY is unique in that it has several ADVANCE blocks between the ENTER and LEAVE blocks, each representing a step in actual issue processing. The first block in the operations section joins all transactions to the queue DUTYQ. The succeeding TEST blocks send entering transactions directly to the block labeled DUTYS if the storage DUTY has available capacity. Those entering before 1646 on workdays or when the storage is full are linked to the user chain DUTYC to await processing.

Transactions transferred directly, as well as those unlinked from user chain DUTYC for processing, proceed to the SPLIT block labeled DUTYS. There, each transaction is split into 3 separate transactions, each representing a single requisition as previously explained. The following TRANSFER block sends the original transaction directly to the ENTER block DUTYE. The newly created transactions are first transferred to QSPLT to be joined to DUTYQ before proceeding to the ENTER block. Transactions proceed beyond the ENTER block as the defined capacity of DUTY permits. They are removed from DUTYQ in the next block and then transferred to the starting point in the duty section module appropriate to the progress indicator stored in parameter 3.

The complete processing of each transaction is then simulated as the transaction passes through the remainder of

the module blocks. When processing is completed, each transaction passes through the dummy ADVANCE block labeled DUTTR, placed to provide a count of leaving transactions that is referenced by the following TEST block. The TEST block allows every third transaction to pass through the next block which unlinks a single transaction (representing 3 requisitions) to DUTYS. The above process is then repeated for the unlinked transaction.

The TRANSFER block SEND transfers transactions that complete processing in the duty section module to termination blocks appropriate to each transaction. At the start of the following workday, any unprocessed transactions remaining on the user chain DUTYC are unlinked to DUTYD by a control transaction in the schedule section. Those transactions are removed from DUTYQ and transferred back to their point of origin indicated by parameter 3. The processing of all transactions that have been split into individual requisitions is completed in the duty section module.

V. VERIFICATION AND VALIDATION

A. INTRODUCTION

This chapter will review verification of the program structure and discuss procedures to be used in the validation of simulation results. Verification and validation are terms used to describe the process of establishing the credibility of simulation models. The verification process entails ensuring that the logic of the computer program corresponds to that of the real system. Validation takes the process a step further, by testing the model to determine if it reasonably reflects real system processes.

Program output used during verification and validation is produced at the end of the simulation. The output is divided into 4 "snapshots" presenting a set of cumulative statistics at the end of each simulated week. The final snapshot of the program output used to verify this model is provided as Appendix C. The sections listed below are of particular interest:

1. Queue statistics
2. Storage statistics
3. Savevalues--total requisition generation count (REQCT), requisition generation count by issue priority group (PRONE, PRTWO and PRTHR), NIS requisition count (NISCT), warehouse refusal count (WRCT) and tractor train run count (ANUM, BNUM and PNUM)
4. Tables--throughput time distribution for all issues (ALL) and throughput time distribution for issues by issue priority group (IPGON, IPGTW, IPGTH)
5. Block counts

Storage statistics provide information regarding the active processing time experienced by transactions (requisitions) during the simulation as well storage (workcenter) utilization information. For each storage defined in the model, GPSS provides standard output that can be used to study system performance. Storage names and capacities are

provided under the corresponding headings. The total number of transactions processed during the simulation may be found in the column labeled "ENTRIES." The average processing time for those transactions that have been processed should closely approximate the mean of the service time data supplied to the program and may be verified by examining data in the column headed "AVERAGE TIME/UNIT". Statistics measuring storage utilization during operating hours are of particular interest to the user. The percentage of time that a storage is available for normal operations is given in the column "PERCENT AVAILABILITY" (e.g., the storage SKCK available 23.8% of the time or $.238 \times 168 \text{ hours} = 40 \text{ hours per week}$). During this period of availability, average utilization may be found under the "AVAIL. TIME" heading. For the storage SKCK, this value was .135 or 13.5%

Queue statistics detail the waiting times experienced by transactions attempting to enter storages in the model. They are provided immediately following storage statistics in a similar format. The maximum, average and total number of requisitions awaiting processing in each of the queues listed in the first column are provided in the next three columns. The column headed "AVERAGE TIME/TRANS" provides the average time spent waiting for processing by all transactions joining the queue. This information is used to isolate delays in transaction processing and is particularly useful during experimentation in identifying system "bottlenecks."

Savevalues are employed as "counters" during the simulation. Savevalues tally the total number of transactions entering the system and provide subtotals by issue priority groups. They are also used to count NIS and warehouse refusal transactions experienced during the simulation. During validation, the output values for savevalues defined in the program may be compared to input parameters to verify

the demand level and mix, acting as a yardstick for evaluating system performance.

Tables defined in the program are designed to provide system throughput data that may be compared to Uniform Material Movement and Issue Priority System (UMMIPS) statistics maintained by the Depot. Tabulate blocks are positioned in the termination module to collect statistics at the point of issue or availability for shipment. The system entry time of each transaction entering a TABULATE block is subtracted from the current simulation clock time, recording the difference as the total issue processing time. The elapsed processing times of all transactions representing issues are aggregated and presented as a frequency distribution table.

The first row of data in each table presents the total number of transactions tabulated, the mean throughput time and the standard deviation. In the body of the frequency distribution table, the data is grouped into predefined intervals whose upper limits are listed in the first column. Because simulated time in the model is based on units of .01 hours, the listed upper limits must be divided by 100 to obtain the correct time in hours. The frequency of occurrence, percentage of total occurrences and cumulative percentage of occurrences in each interval are presented in the next three columns. As in the savevalue output section, one table is used to tabulate all transactions leaving the system and three separate tables present tabulations for the three issue priority groups.

While the block count section of the program does not provide useful information during the validation phase, it is a valuable tool during verification to review transaction flow. A current and total transaction count is provided for each block in the program. This data can be compared to corresponding block operands, especially flow control blocks

like TEST or TRANSFER, to ensure that program logic is consistent with real system operations.

B. VERIFICATION

Steps in the verification phase are designed to expose coding and logic errors. Transaction generation and flow are reviewed using block count and savevalue statistics to verify that the characteristics of requisition flow at NSD Yokosuka is duplicated by the simulation model. The verification phase was completed using the final snapshot in the output listing provided by Appendix C.

The savevalue REQCT counted 39,780 transactions entering the model during the four weeks of simulated operations conducted at a monthly demand level of 43,00 requisitions. Assuming 4.33 weeks to the month, the entry of 39,692 transactions ($(43,000/4.33) \times 4$ weeks) would have been expected. The difference between the requisition receipt rate experienced from that expected is due to truncation during GPSS variable computation and may be compensated for by slightly increasing the demand level.

The characteristics of transactions entering the system were also reviewed. Block counts of the SPLIT blocks in the workday requisition generation subsections were used to compute the percentage of transactions entering during the normal operating hours of the workday. 89% of all workday transactions entered the model during the simulated time period of 0800 - 1645, matching the pattern of real system arrivals. Priority assignment recorded by the savevalues PRION, PRITW and PRITH were compared to the priority assignment input data in function FONE. The recorded number of transactions in each priority group matched expected results.

Requisition flow points representing the routing of online requisitions, perishable provisions requisitions stock checked in Requirements Division, demand exceptions,

NIS requisitions and warehouse refusals were all verified by reviewing block count statistics. All observed counts differed from expected values by less than 1% with the exception of the warehouse refusal count. The difference in warehouse refusals observed from the number expected was 4% and is attributed to the smaller sample size of 67 warehouse refusals.

Warehouse location assignment in the model is handled by the ASSIGN block labeled LOCAS in the warehouse assignment module. A temporary TABULATE block was inserted following LOCAS to determine and verify the assignments to each warehouse area. Observed differences from expected assignments ranged from .01% to 13%. Fluctuations in warehouse arrivals of this magnitude are exceeded by those experienced in normal Depot operations and do not result in appreciable differences in simulation results.

C. VALIDATION

Service time observation data necessary to validate this model is not available to the author. Before validation of the model can begin, frequency distributions of observed service times in F-157, all provisions storage locations and the packing section must be completed and entered as functions in the model. After all of the data distributions are established and verified in the models, the following validation procedure should be used.

In the validation phase, the credibility of the model is established by developing a set of actual performance statistics to compare to queue storage and table statistics produced by the program. Depot performance statistics from a period of at least one month of normal operating tempo should be collected to provide both the demand level to be simulated and the real system performance data used to judge model performance.

The first step in validation should be to review overall system performance. Problems observed in this step will serve as starting points in the identification of module-level problems. Statistics reported by NSD in the Issue Processing Analysis Section of the Supply Distribution and Inventory Control Report (NAVSUP 1144) should be compared to the IPGON, IPGTW and IPGTH tables in the output section of the program. More specifically, for each issue priority group, the cumulative percentage figure for the interval with the upper limit matching the corresponding UMMIPS processing time standard (one, two and eight days respectively) should be compared to the percent shipped on time figure reported on the NAVSUP 1144. Three different basic observations may be made at this point.

1. Simulation throughput time statistics closely approximate real system performance
2. Simulation throughput time statistics differ from real system performance uniformly across issue priority groups.
3. Simulation throughput time statistics differ from real system performance inconsistently across issue priority groups.

In the case of the first observation, remaining validation steps can be limited to a review of queue and storage program output sections. Observation of either of the other two results may require a detailed analysis of the input data used by the model (i.e., service times, storage capacities) and the program logic representing decision rules employed by NSD personnel.

If transaction throughput times by issue priority groups differ uniformly from real system performance, queue and storage data should be compared to corresponding workcenter workloads. For example, if simulated throughput times were uniformly slower than real system operation, queue "AVERAGE CONTENTS" and "AVERAGE TIME/TRANS" data should be examined. Queues reflecting high average contents and reporting long average time per transaction values relative to other queues

should be reviewed first. Conversely, storages reporting high "UTILIZATION DURING AVAIL. TIME" should be examined before storages reporting low utilization. Real system workcenter backlogs, utilization rates and throughput should be compared to data from the suspect queues and storages. Discrepancies identified between actual workcenter performance and corresponding queue and storage statistics will most likely result from understated capacities, overstated or poorly defined service times, or both.

When deviation from real system performance does not occur uniformly across issue priority groups, program logic based on decision rules provided by NSD Yokosuka may not accurately reflect actual operations. For example, if simulated throughput times for IPG1 transactions were significantly faster than real system performance, while IPG2 and IPG3 performance was substantially as expected, handling of IPG1 requisitions in the program should be reviewed. Code segments modeling UC02/UC96 queue files and special delivery of IPG1 issue documents missing normal delivery runs should be compared to real system decision rules. If this review fails to produce an explanation for the discrepancy, intermediate MARK and TABULATE blocks should be inserted to measure throughput time in smaller segments of the program by issue priority groups in an effort to localize the problem.

The validation procedures discussed above are by no means all inclusive, however, they should serve as a guide to the validation process. Simulation model validation is an iterative process. After identified problems have been corrected, the program should be run and the results compared again against real system performance data. When validation is completed, input parameters and output statistics should be retained as a baseline for model experimentation.

VI. EXPERIMENTATION

One major purpose of simulation is to perform experimentation that will provide predictive information regarding real system performance under controlled changes to the system and its conditions. Simulation experiments reviewed in this chapter were conducted for the purpose of demonstrating experimentation techniques. The baseline program used during experimentation models NSD issue processing operations under a normal load of 43,000 requisitions a month and is identical to the program listing provided as Appendix A. The baseline program output referenced is the program output included as Appendix C. As the baseline program has not been validated, it should be emphasized that the results of this series of simulation experiments are useful for illustrative purposes only.

Consider the following demonstration of experimentation procedures. NSD Yokosuka Planning Division analysts have estimated that the support of an additional Carrier Battle Group (CBG) under peacetime conditions would result in a 70% increase in requisitions received. The objective of this series of experiments was to observe simulated issue processing operations of NSD Yokosuka for a period of four weeks under those conditions. The information obtained from the experimental models could be used to estimate the additional resources the Depot might require to continue providing approximately the same level of support.

The experimentation plan calls for an initial run to simulate NSD operations at a monthly demand level of 73,100 requisitions to identify processing bottlenecks in the system. After evaluation of the initial run is completed, adjustments to the model will be made reflecting options that would be available to the Depot during actual operation

(i.e., additional personnel, shift changes, scheduling of additional tractor train runs.) After modifications to the model are completed, the simulation run will be repeated. The results of the second simulation will then be evaluated and the process will continue in an iterative manner until a satisfactory solution is obtained. This plan was executed and the results are explained below.

The throughput time tables, storage and queue statistics produced by the first experiment were compared to Appendix C. The percentage of issues, by issue priority group, made within UMMIPS time standards with UMMIPS performance statistics recorded during normal operating levels did not indicate a serious problem at first glance. IPG1 and IPG2 UMMIPS performance remained essential unchanged. The percentage of IPG3 issues made within the UMMIPS time standard of seven days (16,800 simulation time units) fell from 99.1% under normal conditions to 95.3%. The first indication of a problem was in the actual number of IPG3 issues. The 18,693 IPG3 issues recorded reflected an increase of only 9% over the 17,157 IPG3 issues made during the baseline experiment, though the number of requisitions received increased by 70%. A review of queue statistics explained the modest increase in IPG3 issues. Snapshot queue statistics confirmed that warehouse area A, the main warehouse, the B route tractor train and packing queues steadily increased in length indicating that arrival rates in those areas exceeded the service rates. This was confirmed by utilization rates in the corresponding storages approaching or equaling 100%. The Savevalue count BNUM (the B route tractor train count) underscored the issue transportation problem. The B route required 97 runs to transport issues from warehouse areas A, B, and J, exceeding the scheduled 80 runs by 21%.

Based on these changes in system performance due to the increase in load conditions, the "system" was modified in

the following manner. Since processing bottlenecks were localized in relatively few workcenters, spot adjustments, as opposed to blanket shift changes, were made to compensate for the additional workload. The warehouse area A and main warehouse storage capacities were increased from 2 to 3 and from 8 to 11, respectively. Each modification required a change to the capacity listed in the storage definition block and to the number of transactions unlinked in the user chain control module. The number of heavy pack crews was increased from 3 to 4 and the number of personnel in the light pack line was increased from 5 to 7 by changes to the program code similar to those made to the warehouse storages. Additional tractor train runs on the B route were scheduled at 1500 and 1700 each workday. A single additional run was scheduled on the A route to handle the anticipated increase in issues from the main warehouse. The changes were implemented by duplicating code from an earlier train run, changing only the control transaction generation time. The management discretion train routes previously scheduled for 1500 were rescheduled to 1800 by changing the control transaction generation times.

After the changes were completed, the second simulation experiment was run. The number of IPG1 and IPG2 issues and their UMMIPS performance statistics remained stable in the second run. IPG3 issues increased from 18,693 to 26,403, an increase of 41% over the previous experiment and 54% over the baseline issues. The percentage of IPG3 issues made within UMMIPS time standards increased to 97.1%. The storage and queue statistics of warehouse area A and the main warehouse were returned to acceptable levels by the capacity increases. The A route tractor train queue lengths recorded in the snapshot statistics produced during the second experiment increased only slightly, indicating that the single additional run scheduled was sufficient to handle the

increase in main warehouse issues that had been anticipated. The B route tractor train queue lengths showed significant improvement, however, the average transaction queue waiting time was an unacceptable 117 hours. Packing Section utilization remained at 100% with the increase in storage capacity partially offset by the increase in issues transported by the additional tractor train runs.

The results of the second run indicated that changes to the system were still required in the issue transportation and packing sections. In the third experiment, additional tractor train runs on the B route were scheduled at 0925 and 1125 on workdays to reduce the delay experienced by transactions waiting for transportation on the B route tractor train. The capacity of the heavy pack storage was increased from 4 to 5 and the light pack storage from 7 to 9. The simulation was repeated and results of third simulation experiment were examined. IPG1 and IPG2 statistics remained stable. The number of IPG3 issues rose to 28,683 with 97.8% of all issues made within UMMIPS time standards. All storage utilization rates had fallen sufficiently below 100% to eliminate the exploding queue characteristics observed in the previous experiments.

Experimentation could be continued to restore IPG3 UMMIPS performance standards observed in the baseline simulation by following the same procedures employed in the first three experiments. As observed during this series of experiments, obtaining the desired results is an iterative process. Modifications made to the model depend on the observed conditions unique to each experiment and are easily made by personnel with only a limited background in simulation techniques and GPSS.

VII. SUMMARY

A. CONCLUSIONS

1. Discrete Event Simulation Using GPSS V

Simulation using GPSS V can be an effective predictive tool for NSD Yokosuka planning personnel. The NSD is composed of interrelated queueing systems that may be accurately modeled by discrete event simulation techniques. The system throughput, resource utilization and queue statistics produced by GPSS V during simulation experimentation are well suited to the information requirements of logistics planners. Making program changes during system experimentation is a relatively simple process, well within the capability of personnel with only an introduction to GPSS.

2. Discrete Event Simulation Using GPSS/PC

NSD Yokosuka issue processing operations could not be modeled with Minuteman Software's GPSS/PC because of the substantial memory requirements of the model. Manufacturer suggestions that GPSS/PC will handle 2000 concurrently active transactions indicates that input stream compression on the order of 20 requisitions to each transaction will be necessary to keep memory requirements within the 640 kilobytes permitted by DOS.

B. RECOMMENDATIONS

1. Data Collection

The data collection efforts of NSD Yokosuka should be completed to permit model validation and experimentation using the present GPSS V program. The use of existing mean times to model requisition and issue document handling processes (i.e., remote terminal entry, document sorting) should not have an adverse impact on model performance due

to the brief and uniform nature of the tasks. However, the greater length and variability of service times in warehouse locations and the Packing Section do not permit accurate modeling with estimated mean times. The construction of frequency distributions from random samples of actual service times in the provisions storage locations, F-157 and the Packing Section will be necessary to complete model validation.

2. Model Experimentation

If data collection and model validation efforts can be completed under the coordination of NSD Yokosuka, the cooperation of an activity equipped with an IBM mainframe computer operating under the VM/CMS operating system will be necessary to permit experimentation with the model. Other activities in Japan, the Naval Postgraduate School and the Navy Fleet Material Support Office all offer support possibilities.

3. Microcomputer Implementation of the Model

Eventual implementation of a microcomputer version of the model would permit NSD Yokosuka Planning Division analysts to experiment with the model interactively. If validation of the present model is completed, it should be converted to GPSS/PC and the modifications necessary to compress the input stream should be made. Validation of the GPSS/PC version should then be completed in the same manner as the original model.

APPENDIX A
PROGRAM LISTING

TABLE OF CONTENTS

Program Execution Control Module	54
Input Parameters Module.	55
Variable Computation Module.	57
Boolean Variable Computation Module.	59
Transaction Parameter Module	60
Storage Definition Module.	61
Functions Module	63
Master Schedule Control Module	66
Storage Control Module	67
User Chain Control Module.	68
Requisition Generation Module.	69
Requisition Receipt Module	71
NSD Remote Terminal Entry Module	72
CPU Tests Module	73
Printer Queue Handling Module.	74
Demand Exception Handling Module	75
Warehouse Assignment Module.	76
Storage Control/Storage Office Module.	77
Yokohama Issue Document Delivery Module.	78
Bicycle Messenger Delivery Module.	79
Warehouses Module.	80
Provisions Tractor Train Delivery Module	88
Tractor Train Delivery Module.	89
Freight Terminal Module.	92
Duty Section Module.	94
Termination Module	97
Simulation Run Control Module.	98

```

//YOKO JOB (4939,9999),'MIKE CLIFT',CLASS=G
//*MAIN LINES=(40)
// EXEC GPSSV,REGION.GO=2048K
//SYSIN DD *
        REALLOCATE XAC,20000
        REALLOCATE FAC,0
        REALLOCATE LOG,0
        REALLOCATE TAB,10
        REALLOCATE FSV,15
        REALLOCATE HSV,0
        REALLOCATE BSV,0
        REALLOCATE LSV,0
        REALLOCATE GRP,0
        REALLOCATE FMS,0
        REALLOCATE HMS,0
        REALLOCATE BMS,0
        REALLOCATE LMS,0
        REALLOCATE STO,100
        REALLOCATE QUE,100
        REALLOCATE COM,500000
*****
**                                PROGRAM EXECUTION CONTROL                                **
** THE SIMULATE STATEMENT MUST FOLLOW ALL JCL STATEMENTS AND GPSS **
** REALLOCATE STATEMENTS. IT MARKS THE BEGINNING OF THE EXECUTABLE **
** PROGRAM. THE PRECEDING REALLOCATE STATEMENTS ARE USED TO ALLOCATE**
** ADDRESSABLE MEMORY AMONG VARIOUS ENTITIES DEFINED IN THE PROGRAM.**
*****
*
        SIMULATE                                BEGIN SIMULATION
*

```

```

*****
**          INPUT PARAMETERS          **
** INPUT PARAMETER VARIABLES ARE ASSIGNED VALUES FROM DATA PROVIDED **
** BY NSD. INPUT PARAMETER VARIABLES ARE USED TO CONTROL THE NUMBER **
** AND TYPE OF TRANSACTIONS GENERATED IN THE SIMULATION. THEY MAY **
** BE CHANGED FOR THE PURPOSE OF EXPERIMENTATION. **
*****
**DEMAND LEVEL INPUT PARAMETER*****
*
**TOTAL DEMANDS PER MONTH**
  DMAND VARIABLE    43000
*
**INPUT PARAMETERS EXPRESSED IN NUMBER PER 1000 REQS REC'D*****
*
**GROSS AVAILABILITY**
  GROSS VARIABLE    651
*
**REQUISITIONS RECEIVED VIA AUTODIN, DOSS OR LOCAL CUSTOMER RTE**
  ONLIN VARIABLE    447
*
**NO OF WEEKDAY DEMANDS REC'D DURING WORKDAY**
  DAYDD VARIABLE    891
*
**DEMAND EXCEPTIONS**
  DMDEX VARIABLE    63
*
**PERISHABLE PROVISIONS REQS - 9MP/9MB**
  PERPV VARIABLE    177
*
**DRY PROVISIONS REQS - 9MF**
  DRYPV VARIABLE    67
*
**SHIPS STORE STOCK REQS - 1Q**
  SSS  VARIABLE     13
*
****INPUT PARAMETERS EXPRESSED IN NUMBER PER 1000 ISSUES*****
*
**WAREHOUSE REFUSALS**
  WHREF VARIABLE     3
*
**INPUT PARAMETERS EXPRESSED IN AVERAGE WEIGHT IN LBS OF THREE ISSUES **
**FOR EACH WAREHOUSE AREA (TWO THOUSAND LBS PER MEASUREMENT TON) **
*
**YOKOHAMA COLD STORAGE**
  YMCSW VARIABLE    1245
*
**YOKOSUKA COLD STORAGE (BLDG 1390)**
  YKCSW VARIABLE    1647
*
**DRY (B-47) WAREHOUSE**
  DRYWW VARIABLE    999
*
**A WAREHOUSE**
  AWHEW VARIABLE    1881
*
**B WAREHOUSE**
  BWHEW VARIABLE    2124
*
**MAIN (F-157) WAREHOUSE**
  MAINW VARIABLE    381
*
**F WAREHOUSE**
  FWHEW VARIABLE    2283
*
**J WAREHOUSE**
  JWHEW VARIABLE    3096

```


INPUT PARAMETER - ENTER ISSUE BACKLOG THRESHOLD (LBS) ***
REQUIRED TO SCHEDULE AN ADDITIONAL TRACTOR TRAIN RUNS ***
*
ATRN ROUTE
 AXTRA VARIABLE 64000
*
BTRN ROUTE
 BXTRA VARIABLE 64000
*
PROVISIONS WAREHOUSE ROUTE
 PXTRA VARIABLE 32000
*
INPUT PARAMETER EXPRESSED IN NO. PER 1000 ISSUES RECEIVED IN PACKING
*
NO. ISSUES FOR LIGHT OR PARCEL POST PACK
 LITEP VARIABLE 911

```

*****
**          VARIABLE COMPUTATION          **
** SYMBOLIC NAME, COMPUTATION AND DEFINITION OF VARIABLES REFERENCED**
** DURING THE SIMULATION. VARIABLE VALUES ARE COMPUTED FROM INPUT **
** PARAMETER VARIABLES, OTHER DEFINED VARIABLES OR FUNCTIONS.      **
*****
*
*****COMPUTE DAY OF WEEK INDICATOR*****
**MON=1  TUES=2  WED=3  THU=4  FRI=5  SAT=6  SUN=0**
DAY  VARIABLE  N$DAYC@7
*
**COMPUTE TIME OF DAY**
TIME  VARIABLE  C1@2400
*
**NO OF WEEKDAY DEMANDS NOT REC'D  DURING WORKDAY PER 1000 REQS REC'D**
NITDD VARIABLE  1000-V$DAYDD
*
**WEEKLY DEMANDS GIVEN MONTHLY DEMAND LEVEL**
WDMND VARIABLE  (V$DMAND*231)/1000
*
**DAILY DEMANDS GIVEN MONTHLY DEMAND**
DDMND VARIABLE  ((V$WDMND*FN$FTHNN)/1000)/3
*
**DEMANDS RECEIVED DURING THE WORKDAY**
WRKDD VARIABLE  (V$DDMND*V$DAYDD)/1000
*
**DEMANDS RECEIVED DURING THE WORKDAY AM**
AMDD  VARIABLE  (((V$DDMND*V$NITDD)/1000)*800)/1525
*
**DEMANDS RECEIVED DURING THE WORKDAY PM**
PMDD  VARIABLE  (((V$DDMND*V$NITDD)/1000)*725)/1525
*
**NO REQS SENT TO REQUIREMENTS DIV. FOR STOCK CHECK PER 1000 REQS REC'D**
RQCHK VARIABLE  V$PERPV+V$SSS
*
**NO REQS SENT TO REQUIREMENTS DIV. FOR STOCK**
**CHECK PER 1000 HARD COPY REQS REC'D          **
RQDIV VARIABLE  1000*V$RQCHK/(1000-V$ONLIN)
*
**PROVISIONS REQS PER 1000 REQS REC'D**
PROV  VARIABLE  V$PERPV+V$SSS+V$DRYPV
*
**NO OF DEMAND EXCEPTIONS PER MONTH**
NUMEX VARIABLE  V$DMAND*V$DMDEX/1000
*
**NET DEMAND EXCEPTIONS PER 1000 ISSUES**
NETEX VARIABLE  V$NUMEX*1000/((V$GROSS*V$DMAND)/1000)
*
**TRANSACTIONS NOT DEMAND EXCEPTION PER 1000 ISSUES**
NOTEX VARIABLE  1000-V$NETEX
*
**ISSUES NOT WAREHOUSE REFUSALS PER 1000 ISSUE DOCS SENT TO WAREHOUSE**
NOTWR VARIABLE  1000-V$WHREF
*
**SERVICE TIME VARIABLES (SUM OF 3 FUNCTION CALLS)*****
*
INEXP FVARIABLE  FN$FFORT+FN$FFORT+FN$FFORT+.5

```

```

**SERVICE TIME VARIABLES FOR GROUPS OF THREE - SERVICE TIME MEAN ****
**MULTIPLIED BY V$INEXP FOR SERVICE TIME CONSTRUCTED FROM MEANS - ****
**SUM OF THREE SERVICE TIME FUNCTION CALLS FOR SERVICE TIMES ****
**CONSTRUCTED FROM CONTINUOUS DISTRIBUTIONS ****

SKCKS VARIABLE FN$FELEV*V$INEXP
*
RTES VARIABLE FN$FTWEL*V$INEXP
*
DEEXS VARIABLE FN$FHTN*V$INEXP
*
SCSOS VARIABLE FN$FSXTN*V$INEXP
*
YMCSS VARIABLE FN$FEITN*V$INEXP
*
YKCSS VARIABLE FN$FNNTN*V$INEXP
*
DRYWS VARIABLE FN$FTWEN*V$INEXP
*
AWHES VARIABLE FN$FTWON+FN$FTWON+FN$FTWON
*
BWHES VARIABLE FN$FTWTW+FN$FTWTW+FN$FTWTW
*
MAINS VARIABLE FN$FTWTH*V$INEXP
*
FWHES VARIABLE FN$FTWFR+FN$FTWFR+FN$FTWFR
*
JWHES VARIABLE FN$FTWV+FN$FTWV+FN$FTWV
*
HVYPS VARIABLE FN$FTWSX*V$INEXP
*
LITPS VARIABLE FN$FTWSV*V$INEXP
*
**ESTIMATED WEIGHT OF TRANSACTIONS AWAITING THE TRACTOR TRAINS*****
*
**ATRNRN ROUTE**
AWGHT VARIABLE (CH$MAINC*V$MAINW)+(CH$FCH*V$FWHEW)
*
**BTRNRN ROUTE**
BWGHT VARIABLE (CH$ACH*V$AWHEW)+(CH$BCH*V$BWHEW)+(CH$JCH*V$JWHEW)
*
**PROVISIONS WAREHOUSE ROUTE**
PWGHT VARIABLE CH$PTRNC*((V$YKCSW+V$DRYWW)/2)
*
**VARIABLE COUNTS GROUPS OF 3 LEAVING DUTY SECTION MODULE*****
COUNT VARIABLE N$DUTTR@3

```

```

*****
**          BOOLEAN VARIABLE COMPUTATION          **
** SYMBOLIC NAME, COMPUTATION AND DEFINITION OF BOOLEAN VARIABLES **
** REFERENCED IN THE SIMULATION. BOOLEAN VARIABLES ARE USED IN THE **
** SIMULATION TO CONTROL OPERATIONS SCHEDULING.          **
*****
**WORKDAY INDICATOR, TRUE (1) IF MONDAY THROUGH FRIDAY**
WKDAY BVARIABLE  V$DAY'GE'K1*V$DAY'LE'K5
*
**LUNCHTIME INDICATOR, TRUE IF 1201 - 1245 ON WORKDAY
LUNCH BVARIABLE  V$TIME'GE'K1201*V$TIME'LE'K1275*BV$WKDAY'E'K1
*
**NIGHTTIME INDICATOR, TRUE IF BEFORE 0801 OR AFTER 1645 ON WORKDAY
NIGHT BVARIABLE  (V$TIME'GE'K1676+V$TIME'LE'K800)*BV$WKDAY'E'K1
*
**WORKING HOURS INDICATOR, TRUE IF 0801 - 1200 OR 1246 - 1645 ON WORKDAY
WORKH BVARIABLE  BV$LUNCH'E'K0*BV$NIGHT'E'K0*BV$WKDAY'E'K1
*
**DEPOT OPEN INDICATOR, TRUE IF 0801 - 1645 ON WORKDAY .
OPEN BVARIABLE  BV$LUNCH'E'K1+BV$WORKH'E'K1
*
PTIME BVARIABLE  V$TIME'E'800+V$TIME'E'1000+V$TIME'E'1275+V$TIME'E'1475
*                      SET TO TRUE AT IPG2 PRINT TIMES
*
PRTWO BVARIABLE  BV$WKDAY'E'K1*BV$PTIME'E'K1
*                      SET TO TRUE ON WORKDAYS TO PRINT
*                      IPG2 BATCH
*
PRTHR BVARIABLE  BV$WKDAY'E'1*V$TIME'E'800
*                      SET TO TRUE ON WORKDAYS TO PRINT
*                      IPG3 BATCH
*
BTIME BVARIABLE  V$TIME'E'900+V$TIME'E'1100+V$TIME'E'1375+V$TIME'E'1525
*                      SET TO TRUE AT ISSUE DOC DELIVERY
*                      TIMES
*
DTIME BVARIABLE  BV$WKDAY'E'K1*BV$BTIME'E'K1
*                      SET TO TRUE AT DELIVERY TIME ON
*                      WORKDAYS
*
**BOOLEAN VARIABLE SET TO TRUE IF ISSUE FOR BEARER PICK-UP**
BEAR BVARIABLE  P1'E'K7+P1'E'K5+P1'E'K3
*
**BOOLEAN VARIABLE SET TO TRUE ON EVERY THIRD TRANSACTION LEAVING DUTY**
THREE BVARIABLE  V$COUNT'E'0

```



```

*****
**          TRANSACTION PRIORITIES AND PARAMETERS          **
** KEY TO PRIORITIES AND PARAMETERS ASSIGNED AND REFERENCED DURING **
** THE SIMULATION.                                         **
*****
*
*PRIORITY      REQ PRIORITY      MATCHES P1
*
*P1            REQ PRIORITY      IPG1 BWT              = 7
*                                IPG1 (ALL OTHER)        = 6
*                                IPG2 BWT              = 5
*                                IPG2 CASREPT
*                                (NOT BWT)              = 4
*                                IPG2 QUICK PICK         = 3
*                                IPG2 (ALL OTHER)        = 2
*                                IPG3                  = 1
*
*P2            STORAGE AREAS     YOKOHAMA COLD STORAGE = 1
*                                YOKOSUKA COLD STORAGE = 2
*                                (BUILDING 1390)
*                                DRY PROVISIONS         = 3
*                                (B-47)
*                                A AREA WAREHOUSES       = 4
*                                (A-19)
*                                B AREA WAREHOUSES       = 5
*                                (B-33,B-45,B-46)
*                                MAIN WAREHOUSE         = 6
*                                (F-157)
*                                F AREA WAREHOUSES       = 7
*                                (F-8,F-9,F-10,F-11,
*                                F-12,F-13,F-14)
*                                J AREA WAREHOUSES      = 8
*                                (J-11,J-12 AND GAS,
*                                LUMBER AND DRUM YARDS)
*
*P3            TRANSACTION POINT OF      PARAMETER VALUES EVALUATED
*            PROGRESS PARAMETER          BY FUNCTIONS FTHIR AND FTHON
*            (SPECIFIES DUTY SECTION
*            PROCESSING REQUIRED AND/
*            OR POINT OF RETURN FOR
*            TRANSACTIONS NOT
*            PROCESSED BY THE DUTY
*            SECTION)
*
*P4            NSD TRANSPORTATION      MAJOR CUSTOMER (PWC,SRF) = 1
*            DESTINATIONS              NOTE: NOT ASSIGNED IN
*                                PROVISIONS STORAGE LOCATIONS
*                                PACKING DIVISION        = 2
*                                FREIGHT TERMINAL DIVISION = 3
*
*P5            ISSUE WEIGHT            WEIGHT ASSIGNED TO TRANSACTIONS
*                                EXPRESSED IN LBS
*
*P6            STOCK STATUS            NIS/NC = 1
*                                IN STOCK = 2
*
*P7            DEMAND EXCEPTION STATUS  PROCESSED DEMAND EXCEPTION = 1
*
*P8            WAREHOUSE REFUSAL STATUS WAREHOUSE REFUSAL = 1

```

```

*****
**          STORAGE DEFINITIONS          **
** SYMBOLIC ADDRESS, CAPACITY AND BRIEF EXPLANATION OF NSD **
** FUNCTIONAL AREAS MODELED AS STORAGES WITHIN THE SIMULATION. **
** CAPACITIES REFLECT NUMBER OF PERSONNEL WORKING IN THE MODELED **
** WORKCENTER EXCEPT FOR THE ATRN AND BTRN STORAGES WHICH REFLECT **
** TRACTOR TRAIN CAPACITY IN POUNDS. **
*****
*
*   STORAGE   $$$KCK,6   NO OF CLERKS IN REQUIREMENTS
*                   PERFORMING STOCK CHECKS
*
*   STORAGE   $$CRTE,5   NO OF RTE OPERATORS IN CUST SERV
*                   ENTERING REQS
*
*   STORAGE   $$DRTE,2   NO OF RTE OPERATORS IN DPSC
*                   ENTERING REQS
*
*   STORAGE   $$DEEX,2   NO OF CLERKS IN CUST SERV
*                   PROCESSING DEMAND EXCEPTIONS
*
*   STORAGE   $$$CPR,100000   STORAGE CONTROL PRINTER, UNLIMITED
*                   CAPACITY
*
*   STORAGE   $$CSPR,100000   CUST SERV PRINTER, UNLIMITED
*                   CAPACITY
*
*   STORAGE   $$$CNT,4   NO OF STORAGE CONTROL PERSONNEL
*                   MARKING,BURSTING AND SORTING
*                   ISSUE DOCUMENTS
*
*   STORAGE   $$STOF,1   NO OF STORAGE OFFICE PERSONNEL
*                   MARKING,BURSTING AND SEGREGATING
*                   ISSUE DOCUMENTS
*
*   STORAGE   $$DLVR,100000   ISSUE DOC DELIVERY TO YOKOHAMA
*                   COLD STORAGE, UNLIMITED CAPACITY
*
*   STORAGE   $$YMCS,11   NO. OF WAREHOUSE PERSONNEL AT
*                   YOKOHAMA COLD STORAGE IN ISSUE AND
*                   SHIPMENT PREP OPERATIONS
*
*   STORAGE   $$YKCS,4   NO. OF WAREHOUSE PERSONNEL AT
*                   BUILDING 1390 (YOKSUKA COLD STOR.)
*                   IN ISSUE AND SHIPMENT PREP
*                   OPERATIONS
*
*   STORAGE   $$DRYW,2   NO. OF WAREHOUSE PERSONNEL AT
*                   YOKOSUKA DRY STORAGE (B-47) IN
*                   ISSUE AND SHIPMENT PREP OPERATIONS
*
*   STORAGE   $$AWHE,2   NO. OF WAREHOUSE PERSONNEL AT
*                   A AREA WAREHOUSES IN ISSUE OPS
*
*   STORAGE   $$BWHE,2   NO. OF WAREHOUSE PERSONNEL AT
*                   B AREA WAREHOUSES IN ISSUE OPS
*
*   STORAGE   $$MAIN,8   NO. OF WAREHOUSE PERSONNEL AT
*                   F-157 IN ISSUE OPS
*
*   STORAGE   $$FWHE,1   NO. OF WAREHOUSE PERSONNEL AT
*                   F AREA WAREHOUSES IN ISSUE OPS
*
*   STORAGE   $$JWHE,4   NO. OF WAREHOUSE PERSONNEL AT
*                   J AREA WAREHOUSES IN ISSUE OPS

```

*	STORAGE	S\$ATRN,32000	CAPACITY, EXPRESSED IN POUNDS, OF
*			THE ON-BASE TRACTOR
*			TRAIN (A-ROUTE)
*	STORAGE	S\$BTRN,32000	CAPACITY, EXPRESSED IN POUNDS OF
*			THE ON-BASE TRACTOR
*			TRAIN (B-ROUTE)
*	STORAGE	S\$PTRN,32000	PROVISIONS TRACTOR TRAIN,
*			CAPACITY NOT REFERENCED DURING
*			SIMULATION
*	STORAGE	S\$LITP,5	NO OF PACKERS IN LIGHT PACK LINE
*	STORAGE	S\$HVYP,3	NO OF HEAVY PACK CREWS
*	STORAGE	S\$DUTY,2	TWO MAN DUTY SECTION
*	STORAGE	S\$BIKE,100000	BICYCLE MESSENGER DELIVERING ISSUE
*			DOCUMENTS TO YOKOSUKA STORAGE
*			LOCATIONS

```

*****
**                FUNCTIONS                **
** DEFINITION OF FUNCTIONS USED IN THE SIMULATION PROGRAM. FUNCTIONS **
** ARE PARTIONED BY TYPE.                **
*****
**PARAMETER ASSIGNMENT FUNCTIONS*****
*
  FONE  FUNCTION    RN1,D7                REQ PRIORITY
0.66696,1/.96695,2/.96978,3/.96995,4/.98713,5/.99983,6/1.0,7
*
  FTWO  FUNCTION    RN1,D8                WAREHOUSE LOCATION ASSIGNMENT
0.17127,1/.22920,2/.30846,3/.35334,4
0.40118,5/.90023,6/.94454,7/1.0,8
*
  FTHRE FUNCTION    P2,E8                ASSIGNS FUNCTION TO PROVIDE ISSUE
1,FN$FFOUR/2,FN$FFOUR/3,FN$FFIVE/4,FN$FSIX/5,FN$FSEVE
6,FN$FEIGH/7,FN$FNINE/8,FN$FTEN
*
  FFOUR FUNCTION    RN1,D2                BLDG 1390 ISSUE DEST. ASSIGN.
0.9326,1/1.0,2
*
  FFIVE FUNCTION    RN1,D2                B-47 ISSUE DESTINATION ASSIGNMENT
0.6264,1/1.0,2
*
  FSIX  FUNCTION    RN1,D3                A AREA ISSUE DESTINATION ASSIGN.
0.0389,1/.6897,2/1.0,3
*
  FSEVE FUNCTION    RN1,D3                B AREA ISSUE DESTINATION ASSIGN.
0.2888,1/.7744,2/1.0,3
*
  FEIGH FUNCTION    RN1,D3                F-157 ISSUE DESTINATION ASSIGN.
0.0167,1/.6772,2/1.0,3
*
  FNINE FUNCTION    RN1,D3                F AREA ISSUE DESTINATION ASSIGN.
0.3662,1/.8054,2/1.0,3
*
  FTEN  FUNCTION    RN1,D3                J AREA ISSUE DESTINATION ASSIGN.
0.1357,2/.7312,2/1.0,3
*
**SERVICE TIME ASSIGNMENT FUNCTIONS*****
*
  FELEV FUNCTION    RN1,D2                STOCK CHECK SERVICE TIME
0.0,0/1.0,1
*
  FTWEL FUNCTION    RN1,D2                REMOTE TERMINAL ENTRY SERVICE TIME
0.0,0/1.0,1
*
  FTHTN FUNCTION    P8,E2                FUNCTION ASSIGNMENT FOR DEMAND
0,FN$FFRTN/1,FN$FFFTN
*
  FFRTN FUNCTION    RN1,D2                DEMAND EXCEP. PROCESSING TIME
0.0,0/1.0,1
*
  FFFTN FUNCTION    RN1,D2                WAREHOUSE REF. PROCESSING TIME
0.0,0/1.0,5
*
  FSXTN FUNCTION    RN1,D2                STORAGE CONTROL/STORAGE OFFICE
0.0,0/1.0,1

```


* ASSIGNS FUNCTION TO PROVIDE
 FSVTN FUNCTION P2,E8 WAREHOUSE SERVICE TIME
 1,FNSFEITN/2,FNSFNNTN/3,FNSFTWEN/4,FNSFTWON
 5,FNSFTWTW/6,FNSFTWTH/7,FNSFTWFR/8,FNSFTWV
 *
 FEITN FUNCTION RN1,D2 YOKOHAMA C/S PICK TIME
 0.0,0/1.0,17
 *
 FNNTN FUNCTION RN1,D2 YOKOSUKA C/S (BLDG 1390) PICK TIME
 0.0,0/1.0,17
 *
 FTWEN FUNCTION RN1,D2 B-47 PICK TIME
 0.0,0/1.0,7
 *
 FTWON FUNCTION RN1,C24 A-19 PICK TIME
 0.038,3/.115,5/.192,7/.269,8/.308,10/.333,12
 0.359,13/.423,15/.474,17/.551,18/.628,20
 0.654,22/.692,23/.744,25/.756,27/.769,28/.859,30
 0.872,32/.936,33/.949,40/.962,43/.974,47/.987,50/1.0,57
 *
 FTWTW FUNCTION RN1,C6 B WAREHOUSE PICK TIME
 0.045,7/.545,8/.682,10/.818,13/.955,17/1.0,25
 *
 FTWTH FUNCTION RN1,D2 F-157 PICK TIME
 0.0,0/1.0,8
 *
 FTWFR FUNCTION RN1,C9 F WAREHOUSE PICK TIME
 0.153,1/.292,2/.319,3/.472,5
 0.514,7/.681,8/.917,10/.958,12/1.0,17
 *
 FTWV FUNCTION RN1,C23 J WAREHOUSE PICK TIME
 0.008,3/.085,5/.185,7/.385,8/.462,10/.547,12
 0.585,13/.600,15/.677,17/.692,18/.708,20/.754,25
 0.770,27/.854,33/.885,37/.892,40/.915,42/.931,45
 0.946,47/.969,50/.985,53/.992,200/1.0,267
 *
 FTWSX FUNCTION RN1,D2 HEAVY PACK SERVICE TIME
 0.0,0/1.0,42
 *
 * FUNCTION ASSIGNMENT FOR LIGHT/
 FTWSV FUNCTION RN1,E2 PARCEL POST PROCESSING TIME
 0.939,FNSFTWEI/1.0,FNSFTWNN
 *
 FTWEI FUNCTION RN1,D2 LIGHT PACK SERVICE TIME
 0.0,0/1.0,7
 *
 FTWNN FUNCTION RN1,D2 PARCEL POST PACK SERVICE TIME
 0.0,0/1.0,8
 *
 TRANSACTION TRANSFER LOCATION ASSIGNMENT***
 *
 * TRANSFER LOCATION FOR TRANSACTIONS
 * NOT HANDLED BY THE DUTY SECTION
 * OR NOT RESULTING IN AN ISSUE
 FTHIR FUNCTION P3,D26
 0,SKCKQ/1,CRTEQ/2,DTNIS/3,DEEXO/4,SCNTQ/5,STOFQ/6,DLVRQ/7,BIKEQ
 8,YMCSQ/9,YKCSQ/10,DRYWO/11,AWHEQ/12,BWHEQ/13,MAINQ/14,FWHEQ/15,JWHEQ
 16,POUE/17,AQUE/18,BQUE/19,MQUE/20,FQUE/21,JQUE/22,HVYPQ/23,LITPQ
 24,ALLCT/25,DTWR

```

*                                     TRANSFER LOCATION WITHIN DUTY
FTHON FUNCTION    P3,D23             SECTION BASED ON P3
0,PZERO/1,PONE/3,PTHRE/4,PFOUR/5,PFOUR/6,PSIX/7,PSIX/8,PEIGH
9,PEIGH/10,PEIGH/11,PEIGH/12,PEIGH/13,PEIGH/14,PEIGH/15,PEIGH/16,PSXTN
17,PSXTN/18,PSXTN/19,PSXTN/20,PSXTN/21,PSXTN/22,PTWTW/23,PTWTH
*
FHTW FUNCTION     P2,D8             WAREHOUSE LOCATION TRANSFER
1,YMCSQ/2,YKCSQ/3,DRYWQ/4,AWHEQ/5,BWHEQ/6,MAINQ/7,FWHEQ/8,JWHEQ
*
FHTH FUNCTION     P1,D8             CONTROL TRANSACTION DESTINATION
1,SONE/2,STWO/3,STHRE/4,SFOUR/5,SFIVE/6,SSIX
7,SSEVE/8,SEIGH
*
FTHR FUNCTION     P2,D2             TRANSFER LOCATION FOR TRACTOR
6,MLINK/7,FLINK      TRAIN OVERFLOW (A ROUTE)
*
FTHFV FUNCTION    P2,D3             TRANSFER LOCATION FOR TRACTOR
4,ALINK/5,BLINK/8,JLINK      TRAIN OVERFLOW (B ROUTE)
*
**TRANSPORTATION TIME ASSIGNMENT FUNCTIONS*****
*
FTHSX FUNCTION    P2,D7             BICYCLE MESSENGER ROUTE TIME
2,73/3,18/4,50/5,28/6,7/7,7/8,75      ASSIGN. FOR ISSUE DOC DELIVERY
*
FTHSV FUNCTION    P2,D8             CUSTOMER SERVICE TO WAREHOUSE
1,150/2,10/3,3/4,15/5,5/6,2/7,3/8,13    TRANSPORTATION TIMES
*
FTHEI FUNCTION    P2,D7             WAREHOUSE LOCATION TO BLDG J-39
2,12/3,7/4,13/5,3/6,5/7,8/8,7          TRANSPORTATION TIMES
*
**DAILY DEMAND LEVEL ASSIGNMENT FUNCTIONS*****
*
FTHNN FUNCTION    V$DAY,D7          AVERAGE % OF WEEKLY DEMANDS
0,21/1,168/2,150/3,200/4,201/5,205/6,55      EXPERIENCED ON EACH DAY
*
**STANDARD DISTRIBUTION FUNCTIONS*****
*
FFORT FUNCTION    RN1,C24           INVERSE EXPONENTIAL FUNCTION
0.0/0/.1,.104/.2,.222/.3,.355/.4,.509/.5,.69
0.6/.915/.7,1.2/.75,1.38/.8,1.6/.84,1.83/.88,2.12
0.9,2.3/.92,2.52/.94,2.81/.95,2.99/.96,3.2/.97,3.5
0.98,3.9/.99,4.6/.995,5.3/.998,6.2/.999,7/.9998,8

```

```

*****
**          MASTER SCHEDULE CONTROL          **
** SIMULATE ONE WEEK OF OPERATIONS IN INCREMENTS OF .01 HOURS. A **
** CONTROL TRANSACTION IS GENERATED AT THE BEGINNING OF EACH DAY. **
** ADVANCE BLOCKS ARE USED TO MOVE THE TRANSACTION THROUGH A **
** WORKDAY SCHEDULE. AT APPROPRIATE TIMES, STORAGES REPRESENTING **
** DEPOT WORKCENTERS ARE OPENED AND CLOSED AND TRANSACTIONS ARE **
** LINKED TO AND UNLINKED FROM USER CHAINS BY SENDING THE CONTROL **
** TRANSACTION TO THE STORAGE CONTROL AND USER CHAIN CONTROL **
** MODULES. **
*****
*
*          GENERATE      16800          GENERATE SIMULATION CONTROL
*                                     TRANSACTION
*          TERMINATE      1          TERMINATE SIMULATION
*
**GENERATE A CONTROL TRANSACTION AT THE BEGINNING OF EACH DAY*****
*
* DAYC  GENERATE      2400,0,1          GENERATE CONTROL TRANSACTION
*
*          TEST E '      BV$WKDAY,K1,SEIGH  SEND TO SEIGH IF SAT/SUN ELSE NEXT
*                                     BLOCK
*          ASSIGN        1,K1          TAG FOR RETURN
*          TRANSFER      ,UNAVL        SEND TO UNAVL
*
* SONE  ADVANCE        800          ADVANCE TO 0801
*          ASSIGN        1,K2          TAG FOR RETURN
*          TRANSFER      ,AVAIL        SEND TO AVAIL
* STWO  ASSIGN        1,K3          TAG FOR RETURN
*          TRANSFER      ,START        SEND TO START
*
* STHRE ADVANCE        400          ADVANCE TO 1201
*          ASSIGN        1,K4          TAG FOR RETURN
*          TRANSFER      ,UNAVL        SEND TO UNAVL
*
* SFOUR ADVANCE        75          ADVANCE TO 1246
*          ASSIGN        1,K5          TAG FOR RETURN
*          TRANSFER      ,AVAIL        SEND TO AVAIL
* SFIVE ASSIGN        1,K6          TAG FOR RETURN
*          TRANSFER      ,START        SEND TO START
*
* SSIK  ADVANCE        400          ADVANCE TO 1646
*          ASSIGN        1,K7          TAG FOR RETURN
*          TRANSFER      ,UNAVL        SEND TO UNAVL
* SSEVE ASSIGN        1,K8          TAG FOR RETURN
*          TRANSFER      ,FNISH        SEND TO FNISH
* SEIGH TERMINATE
*                                     TERMINATE CONTROL TRANSACTION

```

```

*****
**                               STORAGE CONTROL                               **
** AVAILABILITY OF STORAGES IS CONTROLLED BY THE MASTER SCHEDULE             **
** CONTROL MODULE. SUNAVAIL CLOSES STORAGES, SAVAIL OPENS THEM               **
** TO COINCIDE WITH NSD NORMAL WORKDAY SCHEDULE. PROCESSING OF               **
** TRANSACTIONS IN STORAGES WHEN THEY ARE MADE UNAVAILABLE IS                **
** COMPLETED.                                                                **
*****

```

```

*
UNAVL SUNAVAIL SKCK
      SUNAVAIL CRTE
      SUNAVAIL DRTE
      SUNAVAIL DEEX
      SUNAVAIL SCNT
      SUNAVAIL STOF
      SUNAVAIL YMCS
      SUNAVAIL YKCS
      SUNAVAIL DRYW
      SUNAVAIL AWHE
      SUNAVAIL BWHE
      SUNAVAIL MAIN
      SUNAVAIL FWHE
      SUNAVAIL JWHE
      SUNAVAIL LITP
      SUNAVAIL HVYP
      TRANSFER FN,FTHTH

```

RETURN TO SIMULATION TIME CONTROL

```

*
AVAIL SAVAIL SKCK
      SAVAIL CRTE
      SAVAIL DRTE
      SAVAIL DEEX
      SAVAIL SCNT
      SAVAIL STOF
      SAVAIL YMCS
      SAVAIL YKCS
      SAVAIL DRYW
      SAVAIL AWHE
      SAVAIL BWHE
      SAVAIL MAIN
      SAVAIL FWHE
      SAVAIL JWHE
      SAVAIL LITP
      SAVAIL HVYP
      TRANSFER FN,FTHTH

```

RETURN TO SIMULATION TIME CONTROL


```

*****
**                                USER CHAIN CONTROL                                **
** TRANSACTIONS ARE PLACED ON USER CHAINS TO SAVE EXECUTION TIME                **
** AND TO MAINTAIN CONTROL OF TRANSACTIONS THAT MUST BE WORKED BY                **
** THE DUTY SECTION. THE "FNISH" SEGMENT REMOVES ALL TRANSACTIONS                 **
** FROM LISTED USER CHAINS AT THE END OF THE WORKDAY AND, WITHIN                 **
** THEIR RESPECTIVE MODULES, HIGH PRIORITY REQUISITIONS ARE SENT TO              **
** THE DUTY SECTION MODULE FOR PROCESSING. THE "START" SEGMENT                   **
** RELEASES ENOUGH TRANSACTIONS TO FILL THE RESPECTIVE STORAGES                   **
** EACH WORKDAY MORNING AND IMMEDIATELY AFTER LUNCH.                             **
*****
*
  FNISH UNLINK SKCKC,SKCKT,ALL,BACK
        UNLINK CRTEC,CRTET,ALL,BACK
        UNLINK DEEXC,DEEXT,ALL,BACK
        UNLINK SCNTC,SCNTT,ALL,BACK
        UNLINK STOFc,STOFT,ALL,BACK
        UNLINK YMCSC,YMCST,ALL,BACK
        UNLINK YKCSC,YKCST,ALL,BACK
        UNLINK DRYWC,DRYWT,ALL,BACK
        UNLINK AWHEC,AWHET,ALL,BACK
        UNLINK BWHEC,BWHET,ALL,BACK
        UNLINK MAINC,MAINT,ALL,BACK
        UNLINK FWHEC,FWHET,ALL,BACK
        UNLINK JWHEC,JWHET,ALL,BACK
        UNLINK HVYPC,HVYPT,ALL,BACK
        UNLINK LITPC,LITPT,ALL,BACK
        TRANSFER FN,FTHTH
*
*
  START UNLINK SKCKC,SKCKE,6,BACK
        UNLINK CRTEC,CRTET,5,BACK
        UNLINK DRTEC,DRTEE,2,BACK
        UNLINK DEEXC,DEEXE,2,BACK
        UNLINK SCNTC,SCNTE,4,BACK
        UNLINK STOFc,STOFE,1,BACK
        UNLINK YMCSC,YMCSE,11,BACK
        UNLINK YKCSC,YKCSE,4,BACK
        UNLINK DRYWC,DRYWE,2,BACK
        UNLINK AWHEC,AWHEE,2,BACK
        UNLINK BWHEC,BWHEE,2,BACK
        UNLINK MAINC,MAINE,8,BACK
        UNLINK FWHEC,FWHEE,1,BACK
        UNLINK JWHEC,JWHEE,4,BACK
        UNLINK HVYPC,HVYPE,3,BACK
        UNLINK LITPC,LITPE,5,BACK
        TRANSFER FN,FTHTH
*
*
  RETURN TO SIMULATION TIME CONTROL
  RETURN TO SIMULATION TIME CONTROL

```

```

*****
**          REQUISITION GENERATION          **
** IN THIS MODULE, SPLIT BLOCKS REFERENCE VARIABLES DEFINED IN **
** TERMS OF INPUT PARAMETERS SET BY THE USER TO GENERATE **
** TRANSACTIONS AT THE DEMAND LEVEL SPECIFIED BY THE USER. **
** TRANSACTIONS ARE ADVANCED INTO THE MODEL AT A UNIFORM RATE, **
** THOUGH THE RATES ARE ADJUSTED TO MATCH REAL SYSTEM ARRIVAL **
** CHARACTERISTICS. FOLLOWING GENERATION, REQUISITIONS ARE ASSIGNED **
** A PRIORITY MATCHING THE PARAMETER 1 ASSIGNMENT. SAVEVALUES THEN **
** RECORD THE TOTAL NUMBER OF REQS GENERATED AND THE NUMBER **
** IN EACH PRIORITY GROUP. **
*****
**          NOTE: **
** ENTITIES FLOWING THROUGH GPSS PROGRAMS ARE KNOWN AS TRANSACTIONS. **
** THE TERM "TRANSACTION" WILL BE USED IN THIS PROGRAM AS A GENERIC **
** TERM FOR REQUISITIONS IN ANY STAGE OF PROCESSING. IN MODULE **
** DESCRIPTIONS AND COMMENTS, TRANSACTIONS MAY BE CALLED REQS **
** (REQUISITIONS), ISSUE DOCS (ISSUE DOCUMENTS) OR ISSUES (AFTER **
** WAREHOUSE PICK) AS APPROPRIATE TO THE MODULE TO CLARIFY THE **
** PROCESS BEING MODELED. TRANSACTIONS USED IN SCHEDULE CONTROL **
** SECTIONS WILL ALWAYS BE REFERRED TO AS CONTROL TRANSACTIONS. **
*****
**          NOTE: **
** GPSS QUEUE AND DEPART BLOCKS ARE PAIRED BEFORE MOST STORAGES TO **
** GATHER QUEUE STATISTICS PROVIDED IN THE OUTPUT. SO THAT QUEUE **
** STATISTICS REFLECT ACTUAL DEMAND LEVELS SIMULATED, ALL **
** TRANSACTIONS JOINING AND DEPARTING QUEUES ARE COUNTED AS THREE. **
** TRANSACTIONS ARE SPLIT AND INDIVIDUALLY QUEUED IN THE DUTY **
** SECTION MODULE. STORAGES ARE BRACKETED BY ENTER AND LEAVE **
** STATEMENTS TO LIMIT TRANSACTION ACCESS TO THE DEFINED CAPACITY **
** OF THE STORAGE. BECAUSE THE PURPOSES OF THESE BLOCKS ARE STANDARD **
** THROUGHOUT THE PROGRAM, THEY WILL NOT GENERALLY BE COMMENTED. **
*****
*
**AM REQUISITION GENERATION (WEEKDAY)*****
*   GENERATE    2400,,1,,8PH   GENERATE A SINGLE TRANSACTION AT
*                               0001 EACH DAY
*   TEST E      BV$WKDAY,K1,RQTRM  TRANSFER TO NEXT BLOCK IF ON A
*                               WORKDAY, ELSE TO RQTRM
*   SPLIT       V$AMDD,AMAD        SPLIT TRANSACTION INTO THE NUMBER
*                               OF REQS REC'D DURING WORKDAY AM
*   AMAD ADVANCE 400,400          SPREAD REQUISITION FLOW UNIFORMLY
*                               THROUGHOUT WORKDAY AM
*   TRANSFER    ,PRIAS           TRANSFER ALL TO PRIAS
*
**WORKING HOURS REQUISITION GENERATION (WEEKDAY)*****
*   GENERATE    2400,,801,,8PH   GENERATE A SINGLE TRANSACTION AT
*                               0801 EACH DAY
*   TEST E      BV$WKDAY,K1,RQTRM  TRANSFER TO NEXT BLOCK IF A
*                               WORKDAY, ELSE TO RQTRM
*   SPLIT       V$WRKDD,DAYAD      SPLIT TRANSACTION INTO THE NUMBER
*                               OF REQS REC'D DURING WORKDAY
*   DAYAD ADVANCE 437,437          SPREAD REQUISITION FLOW UNIFORMLY
*                               THROUGHOUT WORKDAY
*   TRANSFER    ,PRIAS           TRANSFER ALL TO PRIAS
*
**PM REQUISITION GENERATION (WEEKDAY)*****
*   GENERATE    2400,,1676,,8PH  GENERATE A SINGLE TRANSACTION AT
*                               1646 EACH DAY
*   TEST E      BV$WKDAY,K1,RQTRM  TRANSFER TO NEXT BLOCK IF ON A
*                               WORKDAY, ELSE TO RQTRM
*   SPLIT       V$PMDD,PMAD        SPLIT TRANSACTION INTO THE NUMBER
*                               OF REQS REC'D DURING WORKDAY PM
*   PMAD ADVANCE 362,362          SPREAD REQUISITION FLOW UNIFORMLY
*                               THROUGHOUT WORKDAY PM
*   TRANSFER    ,PRIAS           TRANSFER ALL TO PRIAS

```

```

**WEEKEND REQUISITION GENERATION*****
*      GENERATE      2400,,1,,,8PH      GENERATE A SINGLE TRANSACTION AT
*      TEST E      BV$WKDAY,KO,RQTRM      0001 EACH DAY
*      SPLIT      V$DDMND,WKDAD      TRANSFER TO NEXT BLOCK IF ON A
*      WKDAD ADVANCE      1200,1200      WEEKEND, ELSE TO RQTRM
*      TRANSFER      ,PRIAS      SPLIT TRANSACTION INTO THE NUMBER
*      RQTRM TERMINATE      TERMINATE DISCARDED TRANSACTIONS
**PRIORITY ASSIGNMENT AND STATISTICS SECTION*****
*      PRIAS ASSIGN      1,FN$FONE      ASSIGNMENT OF REQ PRIORITY TO P1
*      PRIORITY      P1      ASSIGNMENT OF ACTUAL TRANSACTION
*      SAVEVALUE      REQCT+,1,XF      PRIORITY (MATCHES P1 ASSIGN.)
*      SAVEVALUE      REQCT+,1,XF      COUNTS TOTAL NO OF REQS GENERATED
*      SAVEVALUE      REQCT+,1,XF      COUNTS TOTAL NO OF REQS GENERATED
*      TEST NE      P1,1,CNTTH      COUNTS TOTAL NO OF REQS GENERATED
*      TEST G      P1,5,CNTTW      SEND IPG3 REQS TO CNTTH, ALL
*      SAVEVALUE      PRION+,1,XF      OTHERS TO NEXT BLOCK
*      SAVEVALUE      PRION+,1,XF      SEND IPG2 REQS TO CNTTW, ALL
*      SAVEVALUE      PRION+,1,XF      OTHERS TO NEXT BLOCK
*      TRANSFER      ,RECPT      COUNT IPG1 REQS
*      CNTTW SAVEVALUE      PRITW+,1,XF      COUNT IPG1 REQS
*      SAVEVALUE      PRITW+,1,XF      COUNT IPG1 REQS
*      SAVEVALUE      PRITW+,1,XF      COUNT IPG1 REQS
*      TRANSFER      ,RECPT      TRANSFER ALL TO RECPT
*      CNTTH SAVEVALUE      PRITH+,1,XF      COUNT IPG2 REQS
*      SAVEVALUE      PRITH+,1,XF      COUNT IPG2 REQS
*      SAVEVALUE      PRITH+,1,XF      COUNT IPG2 REQS
*      TRANSFER      ,RECPT      TRANSFER ALL TO RECPT
*      CNTTH SAVEVALUE      PRITH+,1,XF      COUNT IPG3 REQS
*      SAVEVALUE      PRITH+,1,XF      COUNT IPG3 REQS
*      SAVEVALUE      PRITH+,1,XF      COUNT IPG3 REQS

```



```

*****
**              REQUISITION RECEIPT              **
** THE SOURCE OF EACH REQ ENTERING SYSTEM IS DETERMINED. ONLINE REQS **
** ARE SENT TO THE CPU TEST MODULE, 9MP,9MB,1Q REQS TO SKCKQ FOR **
** STOCK CHECK AND OTHER HARD COPY REQS TO THE NSD REMOTE TERMINAL **
** ENTRY MODULE. AFTER 9MP,9MB,1Q REQS ARE STOCK CHECKED, NIS REQS **
** ARE TERMINATED. ALL OTHERS ARE TAGGED AS IN STOCK AND SENT TO **
** SENT TO THE NSD REMOTE TERMINAL ENTRY MODULE. **
*****
**              NOTE:              **
** NON-WORK HOUR TRANSACTION HANDLING IS MANAGED THROUGHOUT THE **
** PROGRAM BY CODE SEGMENTS SIMILAR TO THAT SEPARATED BELOW BY **
** ASTERISKS. THE FIRST THREE TEST STATEMENTS LINK TRANSACTIONS TO **
** THE NAMED USER CHAIN 1) DURING LUNCH; 2) DURING WORKING HOURS **
** IF THE STORAGE IS FULL; 3) AFTER WORKING HOURS EXCEPT FOR HIGH **
** PRIORITY TRANSACTIONS (P1=4,5,6,7) WHICH ARE ASSIGNED A PROGRESS **
** PARAMETER, REMOVED FROM THE QUEUE AND TRANSFERRED TO THE DUTY **
** SECTION MODULE. TRANSACTIONS ARE UNLINKED FROM THE USER CHAIN TO **
** THE STORAGE ENTER BLOCK AT THE BEGINNING OF THE WORKDAY AND AFTER **
** LUNCH TO INITIALLY FILL THE STORAGE. TRANSACTIONS ARE UNLINKED **
** AT THE END OF THE WORKDAY, SO THAT HIGH PRIORITY TRANSACTIONS **
** MAY BE TRANSFERRED TO THE DUTY SECTION MODULE (LOW PRIORITY **
** TRANSACTIONS ARE RELINKED). FINALLY TRANSACTIONS ARE UNLINKED **
** TO THE STORAGE ENTER BLOCK ON A ONE FOR ONE BASIS WITH **
** TRANSACTIONS LEAVING THE STORAGE. THIS SECTION OF CODE APPEARS **
** IN MOST MODULES CONTAINING STORAGES, AND WILL NOT BE COMMENTED **
** ON EXCEPT AS IT DIFFERS FROM THE STANDARD FORMAT. **
*****
RECPT TRANSFER .V$ONLIN,,NISTE      SEND ONLINE REQS TO NIS TEST,
*                                     HARD COPY REQS TO NEXT BLOCK
      TRANSFER .V$RQDIV,,SKCKQ      SEND 1Q,9MP,9MB TO SKCKQ, ALL
*                                     OTHERS TO NEXT BLOCK
      TRANSFER .V$GROSS,,RTETE      SEND NIS REQS TO NEXT BLOCK, ALL
*                                     OTHERS TO RTETE
      ASSIGN    6,K1                TAG NIS REQS
      TRANSFER  ,RTETE              TRANSFER ALL TO RTETE
SKCKQ QUEUE    QSKCK,3
**FLOW CONTROL SEGMENT*****
*      TEST E    BV$LUNCH,K0,SKCKL   SEND ALL TO SKCKL DURING LUNCH,
*                                     ELSE NEXT BLOCK
*      TEST E    BV$WORKH,K1,SKCKT   SEND ALL TO NEXT BLOCK DURING
*                                     WORKING HOURS, ELSE SEND TO SKCKT
*      TEST E    R$SKCK,K0,SKCKE     SEND ALL TO SKCKE IF STORAGE IS
*                                     NOT FULL, ELSE NEXT BLOCK
SKCKL LINK      SKCKC,1PH            LINK TO USER CHAIN SKCKC
SKCKT TEST GE   P1,K4,SKCKA          SEND HI PRI REQS TO NEXT BLOCK,
*                                     ALL OTHERS TO SKCKA
      ASSIGN    3,K0                ASSIGN PROGRESS PARAMETER
      DEPART    QSKCK,3             REMOVE FROM QSKCK
      TRANSFER  ,DUTSC              SEND HI PRI REQS TO DUTSC
SKCKA ADVANCE   1                   DUMMY
      TRANSFER  ,SKCKL              SEND ALL TO SKCKL
**END OF FLOW CONTROL SEGMENT*****
SKCKE ENTER     SKCK
SKCKD DEPART    QSKCK,3
SKCK ADVANCE    V$SKCKS             STOCK CHECK ON 9MP,9MB,9Q
SKCKV LEAVE     SKCK
*      TEST E    BV$WORKH,K1,NISTR   DURING WORKING HOURS, SEND ALL TO
*                                     NEXT BLOCK, ELSE NISTR
*      UNLINK    SKCKC,SKCKE,1,BACK  RELEASE ONE TRANSACTION FROM SKCKC
*
NISTR TRANSFER  .V$GROSS,NISTM,ISTAG SEND NIS REQUISITIONS TO NISTM,
*                                     ALL OTHERS TO ISTAG
ISTAG ASSIGN    6,K2                TAG STOCKED CHECKED REQS
*                                     FOUND IN STOCK
      TRANSFER  ,CRTEQ              TRANSFER ALL TO CRTEQ

```



```

*****
**          NSD REMOTE TERMINAL ENTRY          **
** 9MP,9MB,1Q AND ALL REQS (P1 = 3,4,5,6,7) ENTERED VIA CUST SERV **
** RTE, REQS (P1 = 1,2) ARE ENTERED VIA DPSC RTE. NIS REQS ARE **
** TRANSFERRED TO TERMINATION AND ALL OTHERS ARE SENT TO THE CPU **
** CPU TEST MODULE. **
*****
*
RTETE TEST GE      P1,K3,DRTEQ          SEND IPG3 AND NON 1Q,9MB,9MP IPG2
*                                     REQS TO DRTEQ, ALL OTHERS TO NEXT
*                                     BLOCK
*
**CUSTOMER SERVICES REMOTE TERMINAL ENTRY*****
*
CRTEQ QUEUE        QCRTE,3
*   TEST E         BV$LUNCH,K0,CRTTEL   SEND ALL TO CRTEL DURING LUNCH,
*                                     ELSE NEXT BLOCK
*   TEST E         BV$WORKH,K1,CRTET    SEND ALL TO NEXT BLOCK DURING
*                                     WORKING HOURS, ELSE SEND TO CRTET
*   TEST E         R$CRTE,K0,CRTTEE     SEND ALL TO CRTTEE IF STORAGE IS
*                                     NOT FULL, ELSE NEXT BLOCK
CRTEL LINK         CRTEC,1PH
* CRTET TEST GE    P1,K4,CRTEA          LINK TO USER CHAIN CRTEC
*                                     SEND HI PRI REQS TO NEXT BLOCK,
*                                     ALL OTHERS TO CRTEA
*   ASSIGN         3,K1
*   DEPART         QCRTE,3
*   TRANSFER       ,DUTSC
*   ADVANCE        1
*   TRANSFER       ,CRTEL
*   CRTEE ENTER    CRTE
*   DEPART         QCRTE,3
*   CRTE ADVANCE   V$RTES
*   LEAVE          CRTE
*   TEST E         BV$WORKH,K1,CSTR
*   UNLINK         CRTEC,CRTEE,1,BACK   ENTER REQS VIA CUST SERV RTE
*                                     RELEASE ONE TRANSACTION FROM CTWO
* CSTR TEST E      P6,1,PRTE
*                                     SEND NIS REQS TO NEXT BLOCK, ALL
*                                     OTHER TO PRTE
*   TRANSFER       ,NISTM
*                                     TRANSFER NIS REQS TO NISTM
**DPSC REMOTE TERMINAL ENTRY*****
*
DRTEQ QUEUE        QDRTE,3
*   TEST E         BV$WORKH,K1,DRTEL    SEND ALL TO NEXT BLOCK DURING
*                                     WORKING HOURS, ELSE SEND TO DRTEL
*   TEST E         R$DRTE,K0,DRTEE     SEND ALL TO DRTEE IF STORAGE IS
*                                     NOT FULL, ELSE NEXT BLOCK
*   DRTEL LINK     DRTEC,1PH
*   DRTEE ENTER    DRTE
*   DEPART         QDRTE,3
*   DRTE ADVANCE   V$RTES
*   LEAVE          DRTE
*   TEST E         BV$WORKH,K1,DPTE
*   UNLINK         DRTEC,DRTEE,1,BACK   ENTER REQS VIA DPSC RTE
*                                     RELEASE ONE TRANSACTION FROM DRTEC
*   DPTE TEST E    P6,1,PRTE
*                                     SEND NIS REQS TO NEXT BLOCK, ALL
*                                     OTHER TO PRINTER TEST
*   TRANSFER       ,NISTM
*                                     TRANSFER NIS REQS TO NISTM

```

```

*****
**                                CPU TESTS                                **
** TEST FOR, PROCESS AND RE-ENTER DEMAND EXCEPTIONS. TEST FOR AND **
** TRANSFER ONLINE NIS REQS. ROUTE IPG3 AND NON 9MP,9MB,9MF AND 1Q **
** IPG2 REQS TO STOR CONT PRINTER, BALANCE TO CUST SERV PRINTER IN **
** THE PRINTER QUEUE HANDLING MODULE.                                **
*****
*
NISTE TRANSFER .V$GROSS,NISTM,PRTE SEND NIS REQS TO NISTM, ALL
* OTHERS TO PRTE
*
PRTE TEST L P1,K3,CSPRQ SEND REQS (P1 = 3,4,5,6,7) TO
* CSPRQ, ALL OTHERS TO NEXT BLOCK
*
TRANSFER .V$PROV,SCPRQ,CSPRQ SEND 9MF,9MP,9MB,1Q REQS TO
* CSPRQ, ALL OTHERS TO SCPRQ

```

```

*****
**          PRINTER QUEUE HANDLING          **
** LINK IPG3 REQS ON USER CHAIN THREE, UNLINK THEM TO PRINT ISSUE **
** DOCUMENTS IN STORAGE CONTROL AT 0800 ON WORKDAYS. LINK IPG2 REQS **
** ON USER CHAIN TWO, UNLINK THEM TO PRINT ISSUE DOCUMENTS IN **
** STORAGE CONTROL AT 0800,1000,1245,1445 ON WORKDAYS. LINK ALL **
** IPG1,BWT,CASREPT,QUICK PICK,9MF,9MP,9MB,1Q REQS ON USER CHAIN **
** ONE, UNLINK TO PRINT ISSUE DOCUMENTS ON THE CUST SERV PRINTER **
** EVERY FIVE MINUTES. ALL ISSUE DOCS PRINTED ALL SENT TO THE **
** DEMAND EXCEPTION HANDLING MODULE. PRINTER OPERATIONS ARE **
** MODELED BY THE CONTROL TRANSACTION IN THE PARTITIONED SCHEDULE **
** CONTROL SECTION. **
*****
**PRINTER CONTROL SECTION*****
*
*          GENERATE      25          GENERATE CONTROL TRANSACTION TO
*                                     TRIGGER PRINTER EVERY 15 MIN
*
*          UNLINK        THREE,SCPRE,ALL,BV$PRTHR
*                                     SEND ALL REQS ON USER CHAIN THREE
*                                     TO THE STORAGE CONTROL PRINTER
*
*          UNLINK        TWO,SCPRE,ALL,BV$PRTWO
*                                     SEND ALL REQS ON USER CHAIN TWO
*                                     TO THE STORAGE CONTROL PRINTER
*
*          TERMINATE
*                                     TERMINATE CONTROL TRANSACTION
*
*          GENERATE      5          GENERATE CONTROL TRANSACTION TO
*                                     TRIGGER CUST SERV PRINTER EVERY
*                                     5 MINUTES
*
*          UNLNK UNLINK    ONE,CSPRE,ALL,BACK    SEND ALL REQS ON USER CHAIN ONE
*                                               TO THE CUST SERV PRINTER
*
*          TERMINATE
*                                     TERMINATE CONTROL TRANSACTION
*
**STORAGE CONTROL PRINTER OPERATIONS SECTION*****
*
*          SCPRQ QUEUE    QSCPR,3          ENTER STORAGE CONT PRINTER QUEUE
*
*          TEST E        P1,K1,LKTWO        SEND IPG2 REQS TO LKTWO,
*                                               IPG3 TO NEXT BLOCK
*
*          LINK          THREE,1PH          LINK IPG3 ON USER CHAIN THREE
*          LKTWO LINK    TWO,1PH          LINK IPG2 ON USER CHAIN TWO
*
*          SCPRE ENTER    SCPR
*          DEPART          QSCPR,3          DEPART QUEUE
*          SCPR ADVANCE    SCPR             PRINT ISSUE DOCS
*          LEAVE
*
*          TRANSFER      ,DEXTE          TRANSFER ALL TO DEXTE
*
**CUSTOMER SERVICES PRINTER OPERATIONS SECTION*****
*
*          CSPRQ QUEUE    QCSPR,3          ENTER CUST SERV PRINTER QUEUE
*
*          LINK          ONE,1PH          LINK ALL TO USER CHAIN ONE
*
*          CSPRE ENTER    CSPR
*          DEPART          QCSPR,3          DEPART QUEUE
*          CSPR ADVANCE    CSPR             PRINT ISSUE DOCS
*          LEAVE

```

```

*****
**          DEMAND EXCEPTION HANDLING          **
** TRANSACTIONS ARE RECEIVED FROM THE PRINTER QUEUE HANDLING MODULE **
** AND THE WAREHOUSE MODULE. PREVIOUSLY PROCESSED DEMAND EXCEPTIONS **
** ARE SENT TO THE WAREHOUSE ASSIGNMENT MODULE, WAREHOUSE REFUSALS **
** ARE PROCESSED AS SUCH AND TERMINATED. NEW DEMAND EXCEPTIONS ARE **
** PROCESSED, TAGGED AS COMPLETED AND SENT BACK TO THE PRINTER **
** QUEUE HANDLING MODULE. TRANSACTIONS NOT RESULTING IN DEMAND **
** EXCEPTIONS ARE SENT DIRECTLY TO THE WAREHOUSE ASSIGNMENT MODULE. **
*****
*
DEXTE TEST NE      P7,K1,LOCAS      SEND PROCESSED DEMAND EXCEPTIONS
*                                TO LOCAS, OTHERS TO NEXT BLOCK
*      TRANSFER    .V$NOTEX,,LOCAS  SEND REQS WITH DEMAND EXCEPTIONS
*                                TO NEXT BLOCK, SEND OTHERS TO
*                                LOCAS
*
DEEXQ QUEUE       QDEEX,3
* TEST E          BV$LUNCH,K0,DEEXL SEND ALL TO DEEXL DURING LUNCH,
*                                ELSE NEXT BLOCK
*      TEST E      BV$WORKH,K1,DEEXT SEND ALL TO NEXT BLOCK DURING
*                                WORKING HOURS, ELSE SEND TO DEEXT
*      TEST E      R$DEEX,K0,DEEXE  SEND ALL TO DEEXE IF STORAGE IS
*                                NOT FULL, ELSE NEXT BLOCK
DEEXL LINK         DEEXC,1PH        LINK TO USER CHAIN DEEXC
DEEXT TEST GE      P1,K4,DEEXA      SEND HI PRI REQS TO NEXT BLOCK,
*                                ALL OTHERS TO DEEXA
*      TEST NE      P8,K1,DEEXA     SEND WAREHOUSE REFUSALS TO DEEXA,
*                                ALL OTHERS TO NEXT BLOCK
*      ASSIGN       3,K3            ASSIGN PROGRESS PARAMETER
*      DEPART       QDEEX,3         REMOVE FROM QDEEX
*      TRANSFER     ,DUTSC          SEND HI PRI REQS TO DUTSC
DEEXA ADVANCE      1              DUMMY
* TRANSFER         ,DEEXL          SEND ALL TO DEEXL
DEEXE ENTER        DEEX
DEEX DEPART        QDEEX,3
DEEX ADVANCE       V$DEEXS
* LEAVE            DEEX
* ASSIGN           7,K1
*      TEST E      BV$WORKH,K1,WRTE TAG PROCESSED DEMAND EXCEPTIONS
*                                DURING WORKING HOURS SEND ALL TO
*                                NEXT BLOCK, ELSE WRTE
*      UNLINK      DEEXC,DEEXE,K1,BACK RELEASE ONE TRANSACTION FROM DEEXC
*      WRTE TEST E  P8,K1,PRTE      SEND WAREHOUSE REFUSALS TO NEXT
*                                BLOCK, ALL OTHERS TO PRTE
*
*      TRANSFER    ,WRTRM          TRANSFER ALL TO WRTRM

```



```

*****
**          WAREHOUSE ASSIGNMENT MODULE          **
** ALL ISSUE DOCUMENTS ARE ASSIGNED A WAREHOUSE LOCATION. THOSE **
** ISSUE DOCUMENTS IDENTIFIED AS WAREHOUSE REFUSALS ARE TAGGED AS **
** SUCH. BEARER WALKTHROUGH ISSUE DOCS ARE TAGGED AND ARE **
** TRANSFERRED TO THE WAREHOUSE MODULE WITH A DELAY ASSIGNED BY **
** LOCATION. ALL OTHER ISSUE DOCUMENTS ARE SENT TO THE STORAGE **
** OFFICE/STORAGE CONTROL MODULE.                **
*****
*
LOCAS ASSIGN      2, FN$FTWO          ASSIGN WAREHOUSE LOCATION TO P2
*
      TRANSFER    .V$NOTWR, ,DESTE    SEND WAREHOUSE REFUSALS TO NEXT
*                                     BLOCK, ALL OTHERS TO DESTE
      ASSIGN      8, K1                TAG WAREHOUSE REFUSALS
*
DESTE TEST NE     P1, K5, BWTAD        SEND IPG2 BWT TO BWTAD,
*                                     ALL OTHERS TO NEXT BLOCK
*
      TEST NE     P1, K7, BWTAD        SEND IPG1 BWT TO BWTAD,
*                                     ALL OTHERS TO NEXT BLOCK
*
      TEST G      P2, K3, STOFQ        SEND PROV. REQS TO STORAGE OFF,
*                                     ALL OTHERS TO NEXT BLOCK
*
      TRANSFER    , SCNTQ              TRANSFER ALL TO SCNTQ
*
BWTAD ADVANCE     FN$FTHSV            DELAY TO SIMULATE BEARER
*                                     TRANSPORTATION TO THE WAREHOUSE
*
      TRANSFER    FN, FHTW             SENT ALL TO RESPECTIVE WAREHOUSE
*

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*****
**          STORAGE CONTROL/STORAGE OFFICE          **
** PROVISIONS ISSUE DOCUMENTS ENTER AT STOFQ, ALL OTHERS AT SCNTQ. **
** ISSUE DOCUMENTS ARE MARKED, BURST AND SORTED BY LOCATION. ALL **
** ISSUE DOCUMENTS EXCEPT THOSE BOUND FOR YOKOHAMA COLD STORAGE ARE **
** SENT TO THE BIKE MESSENGER DELIVERY MODULE. YOKOHAMA ISSUE DOCS **
** ARE SENT TO THE YOKOHAMA ISSUE DOCUMENT DELIVERY MODULE. **
*****
*
**STORAGE CONTROL SECTION*****
*
  SCNTQ QUEUE      QSCNT,3
    TEST E      BV$LUNCH,K0,SCNTL      SEND ALL TO SCNTL DURING LUNCH,
*                                     ELSE NEXT BLOCK
    TEST E      BV$WORKH,K1,SCNTT      SEND ALL TO NEXT BLOCK DURING
*                                     WORKING HOURS, ELSE SEND TO SCNTT
    TEST E      R$SCNT,K0,SCNTE        SEND ALL TO SCNTE IF STORAGE IS
*                                     NOT FULL, ELSE NEXT BLOCK
  SCNTL LINK      SCNTC,1PH
  SCNTT TEST GE   P1,K4,SCNTA          LINK TO USER CHAIN SCNTC
*                                     SEND HI PRI REQS TO NEXT BLOCK,
    ASSIGN      3,K4                  ALL OTHERS TO SCNTA
    DEPART      QSCNT,3                ASSIGN PROGRESS PARAMETER
    TRANSFER    ,DUTSC                REMOVE FROM QSCNT
  SCNTA ADVANCE  1                    SEND HI PRI REQS TO DUTSC
    TRANSFER    ,SCNTL                DUMMY
  SCNTE ENTER    SCNT                 SEND ALL TO SCNTL
    DEPART      QSCNT,3
  SCNT ADVANCE   V$SCSOS              MARK,BURST,SORT ISSUE DOCS
    LEAVE       SCNT
*    TEST E      BV$WORKH,K1,SCTE      DURING WORKING HOURS SEND ALL TO
*                                     NEXT BLOCK, ELSE TO SCTE
    UNLINK      SCNTC,SCNTE,1,BACK    RELEASE ONE TRANSACTION FROM SCNTC
*
  SCTE TRANSFER  ,BIKEQ              SEND ALL TO BIKEQ
*
**STORAGE OFFICE SECTION*****
*
  STOFQ QUEUE      QSTOF,3
    TEST E      BV$LUNCH,K0,STOFL      SEND ALL TO STOFL DURING LUNCH,
*                                     ELSE NEXT BLOCK
    TEST E      BV$WORKH,K1,STOFT      SEND ALL TO NEXT BLOCK DURING
*                                     WORKING HOURS, ELSE SEND TO STOFT
    TEST E      R$STOF,K0,STOFE        SEND ALL TO STOFE IF STORAGE IS
*                                     NOT FULL, ELSE NEXT BLOCK
  STOFL LINK      STOFC,1PH
  STOFT TEST GE   P1,K4,STOFA          LINK TO USER CHAIN STOFC
*                                     SEND HI PRI REQS TO NEXT BLOCK,
    ASSIGN      3,K5                  ALL OTHERS TO STOFA
    DEPART      QSTOF,3                ASSIGN PROGRESS PARAMETER
    TRANSFER    ,DUTSC                REMOVE FROM QSTOF
  STOFA ADVANCE  1                    SEND HI PRI REQS TO DUTSC
    TRANSFER    ,STOFL                DUMMY
  STOFE ENTER    STOF                 SEND ALL TO STOFL
    DEPART      QSTOF,3                REMOVE FROM QSTOF
  STOF ADVANCE   V$SCSOS              MARK,BURST,SORT ISSUE DOCS
    LEAVE       STOF
*    TEST E      BV$WORKH,K1,SOTE      DURING WORKING HOURS SEND ALL TO
*                                     NEXT BLOCK, ELSE TO SOTE
    UNLINK      STOFC,STOFE,1,BACK    RELEASE ONE TRANSACTION FROM STOFC
*
  SOTE TEST E     P2,K1,BIKEQ          SEND YOKOHAMA CS DOCS TO NEXT
*                                     BLOCK, SEND ALL OTHERS TO BIKEQ
*
    TRANSFER    ,DLVRT                SEND ALL TO DLVRT

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*****
**      YOKOHAMA ISSUE DOCUMENT DELIVERY      **
** DELIVERY OF ISSUE DOCUMENTS BY PICKUP TRUCK IS SIMULATED IN THIS **
** MODULE. ISSUE DOCS ARRIVING ARE PLACED ON USER CHAIN DLVRC WHICH **
** IS UNLINKED TO YMCSQ WITH AN APPROPRIATE TIME DELAY AT 0830 ON **
** WORKDAYS. BECAUSE DURING ACTUAL OPERATIONS, HIGH PRIORITY ISSUE **
** DOCUMENTS ARRIVING AFTER 0830 ARE NOT DELAYED UNTIL THE NEXT DAY, **
** THOSE HIGH PRIORITY DOCUMENTS ARRIVING DURING THE WORKDAY AFTER **
** 0830 ARE TRANSFERRED DIRECTLY TO YMCSQ TO AVOID UNREALISTIC **
** DELAYS ON THE DLVRC USER CHAIN. HIGH PRIORITY ISSUE DOCUMENTS **
** ARRIVING AFTER WORKING HOURS OR ON WEEKENDS ARE TRANSFERRED TO **
** THE DUTY SECTION MODULE. PICKUP DELIVERY OPERATION SCHEDULING IS **
** CONTROLLED BY THE PARTIONED SCHEDULE CONTROL SECTION.      **
*****
**SCHEDULE CONTROL SECTION*****
*
*      GENERATE      2400,,850      GENERATE CONTROL TRANSACTION TO
*      UNLINK      DLVRC,DLVRE,ALL,BV$WKDAY      TRIGGER YOKOHAMA DELIVERY
*
*      SEND ISSUE DOCS ON DELIVER USER
*      CHAIN TO DLVRE
*
*      TERMINATE      TERMINATE CONTROL TRANSACTION
*
**OPERATIONS SECTION*****
*
*      DLVRT TEST G      P1,K3,DLVRQ      SEND LOW PRI ISSUE DOCS TO DLVRQ,
*      TEST E      BV$OPEN,K1,DLVTR      ALL OTHERS TO NEXT BLOCK
*      TEST G      V$TIME,K0850,DLVRQ      IF OUTSIDE OF DEPOT WORKING HOURS,
*      TRANSFER      ,YMCSQ      SEND TO DLVTR, ELSE NEXT BLOCK
*      TRANSFER      ,YMCSQ      IF AFTER DAILY RUN, SEND TO NEXT
*      TRANSFER      ,YMCSQ      BLOCK, ELSE DLVRQ
*      TRANSFER      ,YMCSQ      TRANSFER ALL TO YMCSQ
*
*      DLVTR ASSIGN      3,K6      ASSIGN PROGRESS PARAMETER
*      TRANSFER      ,DUTSC      SEND ALL TO DUTSC
*
*      DLVRQ QUEUE      QDLVR,3      ENTER QUEUE FOR REQ DELIVERY
*      DLVRQ QUEUE      QDLVR,3      TO YOKOHAMA CS
*
*      DLVRL LINK      DLVRC,1PH      WAIT ON USER CHAIN DLVRC
*
*      DLVRE ENTER      DLVR
*      DEPART      QDLVR,3      DEPART QUEUE
*      ADVANCE      150,50      DELIVERY TO YOKOHAMA
*      LEAVE      DLVR
*
*      TRANSFER      ,YMCSQ      TRANSFER ALL TO YOKOHAMA COLD
*      TRANSFER      ,YMCSQ      STORAGE QUEUE

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*****
**          BICYCLE MESSENGER DELIVERY          **
** THIS MODULE DELIVERS ISSUE DOCUMENTS TO WAREHOUSE LOCATIONS BY **
** BICYCLE MESSENGER AT 0900,1100,1345 AND 1515 ON WORKDAYS. HIGH **
** PRIORITY REQS ARRIVING DURING WORKING HOURS AFTER THE LAST RUN **
** ARE TRANSFERRED TO THE WAREHOUSE MODULE DIRECTLY TO SIMULATE **
** DELIVERY BY OFFICE PERSONNEL IN ACCORDANCE WITH ACTUAL **
** PROCEDURES. THE SCHEDULE CONTROL SECTION IS PARTIONED IN THE **
** TOP HALF OF THE MODULE. **
*****
**SCHEDULE CONTROL SECTION*****
*
*      GENERATE      25                      GENERATE CONTROL TRANSACTION TO
*                                         TRIGGER PRINTER EVERY 15 MIN
*
*      UNLINK      BIKEC, BIKEE, ALL, BV$D TIME
*                                         SEND ALL ISSUE DOCS ON USER CHAIN
*                                         BIKEC TO BIKEQ
*
*      TERMINATE                      TERMINATE CONTROL TRANSACTION
**OPERATIONS SECTION*****
*
*      BIKEQ QUEUE      OBIKE, 3
*      TEST GE      P1, K4, BIKEL      SEND LOW PRI REQS TO BIKEL,
*                                         ALL OTHERS TO NEXT BLOCK
*      TEST G      V$TIME, K1525, BIKEL  IF BEFORE LAST MESSENGER RUN, SEND
*                                         ALL TO BIKEL, ELSE NEXT BLOCK
*      TEST L      V$TIME, K1676, BIKTR  IF DURING WORKING HOURS SEND TO
*                                         NEXT BLOCK, ELSE BIKTR
*
*      DEPART      OBIKE, 3
*      ADVANCE      FNSFTHSV
*      TRANSFER      , WHTR      OFFICE PERSONNEL DELIVER
*                                         SEND HI PRI REQS TO WHTR
*
*      BIKTR DEPART      OBIKE, 3
*      ASSIGN      3, K7
*      TRANSFER      , DUTSC      ASSIGN PROGRESS PARAMETER
*                                         SEND HI PRI REQS TO DUTSC
*
*      BIKEL LINK      BIKEC, 1PH      LINK ALL ISSUE DOCUMENTS AWAITING
*                                         TRANSPORTATION TO BIKEC
*
*      BIKEE ENTER      BIKE
*      DEPART      OBIKE, 3
*      ADVANCE      FNSFTHSX
*      LEAVE      BIKE      DELIVER ISSUE DOCS TO WAREHOUSES

```



```

*****
**                                WAREHOUSES                                **
** ISSUE DOCUMENTS ARE SENT TO THE WAREHOUSE INDICATED BY P2.              **
** PICKING, STAGING AND SHIPMENT PREPARATION (PROVISIONS WAREHOUSES **
** ONLY) FUNCTIONS ARE SIMULATED. WAREHOUSE REFUSALS ARE TRANSFERRED **
** TO THE DEMAND EXCEPTION MODULE FOR PROCESSING. BWT AND QUICK            **
** PICK ISSUES ARE TRANSFERRED TO TERMINATION AS WELL AS ISSUES            **
** MADE AVAILABLE FOR SHIPMENT DIRECTLY FROM PROVISIONS WAREHOUSES. **
** ISSUES FROM YOKOSUKA COLD STORAGE AND B-47 REQUIRING PACKING            **
** OR SHIPMENT FROM THE FREIGHT TERMINAL ARE TRANSFERRED TO THE            **
** PROVISIONS TRACTOR TRAIN MODULE. ALL OTHER ISSUES FROM GENERAL          **
** STORAGE LOCATIONS ARE SENT TO THE TRACTOR TRAIN DELIVERY MODULE. **
** WAREHOUSE SUBMODULES ARE PARTIONED AND LABELED.                        **
*****
*
WHTR  TRANSFER  FN,FTHTW                                TRANSFER ISSUE DOCS TO STORAGE
*                                           LOCATION
*
*YOKOHAMA COLD STORAGE*****
*
YMCSQ  QUEUE      QYMCS,3
*      TEST E      BV$LUNCH,KO,YMCSL  SEND ALL TO YMCSL DURING LUNCH,
*                                           ELSE NEXT BLOCK
*      TEST E      BV$WORKH,K1,YMCST  SEND ALL TO NEXT BLOCK DURING
*                                           WORKING HOURS, ELSE SEND TO YMCST
*      TEST E      R$YMCS,KO,YMCSE   SEND ALL TO YMCSE IF STORAGE IS
*                                           NOT FULL, ELSE NEXT BLOCK
YMCSL  LINK        YMCSC,1PH          LINK TO USER CHAIN YMCSC
YMCSL  TEST GE     P1,K4,YMCSA        SEND HI PRI REQS TO NEXT BLOCK,
*                                           ALL OTHERS TO YMCSA
*                                           ASSIGN PROGRESS PARAMETER
*                                           REMOVE FROM QYMCS
YMCSA  ADVANCE     1                  SEND HI PRI REQS TO DUTSC
*                                           DUMMY
*                                           SEND ALL TO YMCSL
YMCSA  TRANSFER    ,YMCSL
YMCSA  ENTER       YMCS
YMCSA  DEPART      QYMCS,3
YMCS   ADVANCE     V$YMCS
YMCS   LEAVE       YMCS
*      TEST E      BV$WORKH,K1,YMTE   DURING WORKING HOURS SEND ALL TO
*                                           NEXT BLOCK, ELSE TO YMTE
*      UNLINK      YMCSC,YMCSE,1,BACK  RELEASE ONE TRANSACTION FROM YMCSC
*
YMTE   TEST NE     P8,K1,DEEXQ        SEND WAREHOUSE REFUSALS TO
*                                           EXCEPTION HANDLING
*
*      TRANSFER    ,TERM              TERMINATE REQS AVAILABLE FOR
*                                           SHIPMENT

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**YOKOSUKA COLD STORAGE*****
YKCSQ QUEUE QYKCS,3
* TEST E BV$LUNCH,KO,YKCSL SEND ALL TO YKCSL DURING LUNCH,
ELSE NEXT BLOCK
* TEST E BV$WORKH,K1,YKCST SEND ALL TO NEXT BLOCK DURING
WORKING HOURS, ELSE SEND TO YMCST
* TEST E R$YKCS,KO,YKCSE SEND ALL TO YKCSE IF STORAGE IS
NOT FULL, ELSE NEXT BLOCK
YKCSL LINK YKCS,1PH LINK TO USER CHAIN YKCS
YKCST TEST GE P1,K4,YKCSA SEND HI PRI REQS TO NEXT BLOCK,
* ALL OTHERS TO YKCSA
ASSIGN 3,K9 ASSIGN PROGRESS PARAMETER
DEPART QYKCS,3 REMOVE FROM QYKCS
TRANSFER ,DUTSC SEND HI PRI REQS TO DUTSC
YKCSA ADVANCE 1 DUMMY
TRANSFER ,YKCSL SEND ALL TO YKCSL
YKCSE ENTER YKCS
DEPART QYKCS,3
YKCS ADVANCE V$YKCSS PICK AND STAGE MATERIAL
LEAVE YKCS
TEST E BV$WORKH,K1,YKTE DURING WORKING HOURS SEND ALL TO
NEXT BLOCK, ELSE TO YKTE
* UNLINK YKCS,YKCSE,1,BACK RELEASE ONE TRANSACTION FROM YKCS
*
YKTE TEST NE P8,K1,DEEXQ SEND WAREHOUSE REFUSALS TO
* EXCEPTION HANDLING
*
* TEST E BV$BEAR,KO,TERM SEND BEARER ISSUES TO TERM,
ALL OTHERS TO NEXT BLOCK
*
* ASSIGN 4,FN$FFOUR ASSIGN ISSUE DESTINATIONS TO P4
*
* ASSIGN 5,V$YKCSW ASSIGN ISSUE WEIGHT
*
* TEST NE P4,K1,TERM SEND ISSUES FOR PACKING OR FREIGHT
* TERMINAL SECTION TO NEXT BLOCK,
* ALL OTHERS TO TERM
*
TRANSFER ,PTRNQ TRANSFER ALL TO PTRNQ

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```

**B-47 (DRY PROVISIONS)*****
DRYWQ QUEUE QDRYW,3
* TEST E BV$LUNCH,K0,DRYWL SEND ALL TO DRYWL DURING LUNCH,
ELSE NEXT BLOCK
* TEST E BV$WORKH,K1,DRYWT SEND ALL TO NEXT BLOCK DURING
WORKING HOURS, ELSE SEND TO DRYWT
* TEST E R$DRYW,K0,DRYWE SEND ALL TO DRYWE IF STORAGE IS
NOT FULL, ELSE NEXT BLOCK
DRYWL LINK DRYWC,1PH LINK TO USER CHAIN DRYWC
DRYWT TEST GE P1,K4,DRYWA SEND HI PRI REQS TO NEXT BLOCK,
* ALL OTHERS TO DRYWA
ASSIGN 3,K10 ASSIGN PROGRESS PARAMETER
DEPART QDRYW,3 REMOVE FROM QDRYW
TRANSFER ,DUTSC SEND HI PRI REQS TO DUTSC
DRYWA ADVANCE 1 DUMMY
DRYWE ENTER ,DRYWL SEND ALL TO DRYWL
DEPART QDRYW,3
DRYW ADVANCE V$DRYWS PICK AND STAGE MATERIAL
LEAVE DRYW
TEST E BV$WORKH,K1,DRYT DURING WORKING HOURS SEND ALL TO
NEXT BLOCK, ELSE TO DRYT
* UNLINK DRYWC,DRYWE,1,BACK RELEASE ONE TRANSACTION FROM DRYWC
*
DRYT TEST NE P8,K1,DEEXQ SEND WAREHOUSE REFUSALS TO
* EXCEPTION HANDLING
*
* TEST E BV$BEAR,K0,TERM SEND BEARER ISSUES TO TERM, ALL
OTHERS TO NEXT BLOCK
*
* ASSIGN 4,FN$FFIVE ASSIGN ISSUE DESTINATION
*
* ASSIGN 5,V$DRYWW ASSIGN ISSUE WEIGHT
*
* TEST NE P4,K1,TERM SEND ISSUES FOR PACKING OR FREIGHT
* TERMINAL SECTION TO NEXT BLOCK,
* ALL OTHERS TO TERM
*
TRANSFER ,PTRNQ TRANSFER ALL TO PTRNQ

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```

*A WAREHOUSE AREA (A-19)*****
AWHEQ QUEUE QAWHE,3
* TEST E BV$LUNCH,KO,AWHEL SEND ALL TO AWHEL DURING LUNCH,
ELSE NEXT BLOCK
* TEST E BV$WORKH,K1,AWHET SEND ALL TO NEXT BLOCK DURING
WORKING HOURS, ELSE SEND TO AWHET
* TEST E R$AWHE,KO,AWHEE SEND ALL TO AWHEE IF STORAGE IS
NOT FULL, ELSE NEXT BLOCK
AWHEL LINK AWHEC,1PH LINK TO USER CHAIN AWHEC
AWHET TEST GE P1,K4,AWHEA SEND HI PRI REQS TO NEXT BLOCK,
* ALL OTHERS TO AWHEA
ASSIGN 3,K11 ASSIGN PROGRESS PARAMETER
DEPART QAWHE,3 REMOVE FROM QAWHE
TRANSFER ,DUTSC SEND HI PRI REQS TO DUTSC
AWHEA ADVANCE 1 DUMMY
TRANSFER ,AWHEL SEND ALL TO AWHEL
AWHEE ENTER AWHE
DEPART QAWHE,3
AWHE ADVANCE V$AWHES PICK AND BIN MATERIAL
LEAVE AWHE
TEST E BV$WORKH,K1,AWHT DURING WORKING HOURS SEND ALL TO
NEXT BLOCK, ELSE TO AWHT
* UNLINK AWHEC,AWHEE,1,BACK RELEASE ONE TRANSACTION FROM AWHEC
*
AWHT TEST NE P8,K1,DEEXQ SEND WAREHOUSE REFUSALS TO
* EXCEPTION HANDLING
*
* TEST E BV$BEAR,KO,TERM SEND BEARER ISSUES TO TERM, ALL
OTHERS TO NEXT BLOCK
*
* ASSIGN 4,FN$FSIX ASSIGN ISSUE DESTINATION
ASSIGN 5,V$AWHEW ASSIGN ISSUE WEIGHT
*
* TEST G V$TIME,1450,AQUE IF LAST TRACTOR TRAIN OF DAY HAS
DEPARTED, SEND TO NEXT BLOCK, ELSE
* AQUE
* TEST GE P1,K4,AQUE SEND HI PRI REQS TO NEXT BLOCK,
ALL OTHERS TO AQUE
*
* ASSIGN 3,K17 ASSIGN PROGRESS PARAMETER
* TRANSFER ,DUTSC TRANSFER ALL TO DUTSC
*
AQUE QUEUE QBTRN,3
ALINK LINK ACH,1PH PLACE TRANSACTIONS ON A USER CHAIN
AWAITING ON-BASE TRANSPORTATION

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```

**B WAREHOUSE AREA (B-34,B-45,B-46)*****
BWHEQ QUEUE QBWHE,3
TEST E BV$LUNCH,KO,BWHEL SEND ALL TO BWHEL DURING LUNCH,
* ELSE NEXT BLOCK
* TEST E BV$WORKH,K1,BWHET SEND ALL TO NEXT BLOCK DURING
* TEST E R$BWHE,KO,BWHEE SEND ALL TO BWHEE IF STORAGE IS
* LINK TO USER CHAIN BWHEC NOT FULL, ELSE NEXT BLOCK
BWHEL LINK BWHEC,1PH
BWHET TEST GE P1,K4,BWHEA SEND HI PRI REQS TO NEXT BLOCK,
* ALL OTHERS TO BWHEA
ASSIGN 3,K12 ASSIGN PROGRESS PARAMETER
DEPART QBWHE,3 REMOVE FROM QBWHE
TRANSFER ,DUTSC SEND HI PRI REQS TO DUTSC
BWHEA ADVANCE 1 DUMMY
TRANSFER ,BWHEL SEND ALL TO BWHEL
BWHEE ENTER BWHE
DEPART QBWHE,3
BWHE ADVANCE V$BWHE$ PICK AND STAGE MATERIAL
LEAVE BWHE
TEST E BV$WORKH,K1,BWHT DURING WORKING HOURS SEND ALL TO
* NEXT BLOCK, ELSE TO BWHT
* UNLINK BWHEC,BWHEE,1,BACK RELEASE ONE TRANSACTION FROM BWHEC
* BWHT TEST NE P8,K1,DEEXQ SEND WAREHOUSE REFUSALS TO
* EXCEPTION HANDLING
* TEST E BV$BEAR,KO,TERM SEND BEARER ISSUES TO TERM, ALL
* OTHERS TO NEXT BLOCK
* ASSIGN 4,FN$FSEVE ASSIGN ISSUE DESTINATION
* ASSIGN 5,V$BWHEW ASSIGN ISSUE WEIGHT
* TEST G V$TIME,1433,BQUE IF LAST TRACTOR TRAIN OF DAY HAS
* DEPARTED, SEND TO NEXT BLOCK, ELSE
* BQUE BQUE
* TEST GE P1,K4,BQUE SEND HI PRI REQS TO NEXT BLOCK,
* ALL OTHERS TO BQUE
* ASSIGN 3,K18 ASSIGN PROGRESS PARAMETER
* TRANSFER ,DUTSC TRANSFER ALL TO DUTSC
* BQUE QUEUE QBTRN,3
BLINK LINK BCH,1PH PLACE TRANSACTIONS ON A USER CHAIN
* AWAITING ON-BASE TRANSPORTATION

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**F-157*****
MAINQ  QUEUE      QMAIN,3
      TEST E      BV$LUNCH,KO,MAINL    SEND ALL TO MAINL DURING LUNCH,
*                                     ELSE NEXT BLOCK
      TEST E      BV$WORKH,K1,MAINT    SEND ALL TO NEXT BLOCK DURING
*                                     WORKING HOURS, ELSE SEND TO MAINT
      TEST E      R$MAIN,KO,MAINE      SEND ALL TO MAINE IF STORAGE IS
*                                     NOT FULL, ELSE NEXT BLOCK
MAINL  LINK       MAINC,1PH            LINK TO USER CHAIN MAINC
MAINT  TEST GE    P1,K4,MAINA          SEND HI PRI REQS TO NEXT BLOCK,
*                                     ALL OTHERS TO MAINA
      ASSIGN      3,K13                ASSIGN PROGRESS PARAMETER
      DEPART      QMAIN,3              REMOVE FROM QMAIN
      TRANSFER    ,DUTSC               SEND HI PRI REQS TO DUTSC
MAINA  ADVANCE    1                    DUMMY
      TRANSFER    ,MAINL               SEND ALL TO MAINL
MAINE  ENTER      MAIN
      DEPART      QMAIN,3
MAIN   ADVANCE    V$MAINS
      LEAVE       MAIN
      TEST E      BV$WORKH,K1,TMAIN    DURING WORKING HOURS SEND ALL TO
*                                     NEXT BLOCK, ELSE TO TMAIN
      UNLINK      MAINC,MAINE,1,BACK    RELEASE ONE TRANSACTION FROM MAINC
*
TMAIN  TEST NE    P8,K1,DEEXQ          SEND WAREHOUSE REFUSALS TO
*                                     EXCEPTION HANDLING
*
      TEST E      BV$BEAR,KO,TERM      SEND BEARER ISSUES TO TERM, ALL
*                                     OTHERS TO NEXT BLOCK
*
      ASSIGN      4,FN$FEIGH           ASSIGN ISSUE DESTINATION
      ASSIGN      5,V$MAINW            ASSIGN ISSUE WEIGHT
*
      TEST G      V$TIME,1410,MQUE     IF LAST TRACTOR TRAIN OF DAY HAS
*                                     DEPARTED, SEND TO NEXT BLOCK, ELSE
*                                     MQUE
      TEST GE     P1,K4,MQUE           SEND HI PRI REQS TO NEXT BLOCK,
*                                     ALL OTHERS TO MQUE
*
      ASSIGN      3,K19                ASSIGN PROGRESS PARAMETER
*
      TRANSFER    ,DUTSC               TRANSFER ALL TO DUTSC
*
MQUE   QUEUE      QATRN,3
MLINK  LINK       MCH,1PH              PLACE TRANSACTIONS ON A USER CHAIN
*                                     AWAITING ON-BASE TRANSPORTATION

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```

**F WAREHOUSE AREA (F-8 - F-14)*****
FWHEQ QUEUE QFWHE,3
* TEST E BV$LUNCH,K0,FWHEL SEND ALL TO FWHEL DURING LUNCH,
ELSE NEXT BLOCK
* TEST E BV$WORKH,K1,FWHET SEND ALL TO NEXT BLOCK DURING
WORKING HOURS, ELSE SEND TO FWHET
* TEST E R$FWHE,K0,FWHEE SEND ALL TO FWHEE IF STORAGE IS
NOT FULL, ELSE NEXT BLOCK
FWHEL LINK FWHEC,1PH LINK TO USER CHAIN FWHEC
FWHET TEST GE P1,K4,FWHEA SEND HI PRI REQS TO NEXT BLOCK,
* ALL OTHERS TO FWHEA
ASSIGN 3,K14 ASSIGN PROGRESS PARAMETER
DEPART QFWHE,3 REMOVE FROM QFWHE
TRANSFER ,DUTSC SEND HI PRI REQS TO DUTSC
FWHEA ADVANCE 1 DUMMY
TRANSFER ,FWHEL SEND ALL TO FWHEL
FWHEE ENTER FWHE
DEPART QFWHE,3
FWHE ADVANCE V$FWHES PICK AND STAGE MATERIAL
LEAVE FWHE
TEST E BV$WORKH,K1,FWHT DURING WORKING HOURS SEND ALL TO
NEXT BLOCK, ELSE TO FWHT
* UNLINK FWHEC,FWHEE,1,BACK RELEASE ONE TRANSACTION FROM FWHEC
* FWHT TEST NE P8,K1,DEEXQ SEND WAREHOUSE REFUSALS TO
* EXCEPTION HANDLING
* TEST E BV$BEAR,K0,TERM SEND BEARER ISSUES TO TERM, ALL
OTHERS TO NEXT BLOCK
* ASSIGN 4,FN$FNINE ASSIGN ISSUE DESTINATION
* ASSIGN 5,V$FWHEW ASSIGN ISSUE WEIGHT
* TEST G V$TIME,1410,FQUE IF LAST TRACTOR TRAIN OF DAY HAS
DEPARTED, SEND TO NEXT BLOCK, ELSE
* FQUE
* TEST GE P1,K4,FQUE SEND HI PRI REQS TO NEXT BLOCK,
ALL OTHERS TO FQUE
* ASSIGN 3,K20 ASSIGN PROGRESS PARAMETER
* TRANSFER ,DUTSC TRANSFER ALL TO DUTSC
* FQUE QUEUE QATRN,3
FLINK LINK FCH,1PH PLACE TRANSACTIONS ON A USER CHAIN
AWAITING ON-BASE TRANSPORTATION

```

```

**J WAREHOUSE AREA (J-11,J-12 AND GAS, LUMBER AND DRUM YARDS)*****
JWHEQ QUEUE      QJWHE,3
  TEST E        BV$LUNCH,KO,JWHEL
*
  TEST E        BV$WORKH,K1,JWHET
*
  TEST E        R$JWHE,KO,JWHEE
*
JWHEL LINK      JWHEC,1PH
JWHET TEST GE   P1,K4,JWHEA
*
  ASSIGN        3,K15
  DEPART        QJWHE,3
  TRANSFER      ,DUTSC
JWHEA ADVANCE   1
  TRANSFER      ,JWHEL
JWHEE ENTER     JWHE
  DEPART        QJWHE,3
JWHE ADVANCE    V$JWHES
  LEAVE         JWHE
  TEST E        BV$WORKH,K1,JWHT
*
  UNLINK        JWHEC,JWHEE,1,BACK
*
JWHT TEST NE    P8,K1,DEEXQ
*
  TEST E        BV$BEAR,KO,TERM
*
  ASSIGN        4,FN$FTEN
*
  ASSIGN        5,V$JWHEW
*
  TEST G        V$TIME,1410,JQUE
*
  TEST GE       P1,K4,JQUE
*
  ASSIGN        3,K21
*
  TRANSFER      ,DUTSC
*
JQUE QUEUE      QBTRN,3
JLINK LINK      JCH,1PH
*

```

SEND ALL TO JWHEL DURING LUNCH,
 ELSE NEXT BLOCK
 SEND ALL TO NEXT BLOCK DURING
 WORKING HOURS, ELSE SEND TO JWHET
 SEND ALL TO JWHEE IF STORAGE IS
 NOT FULL, ELSE NEXT BLOCK
 LINK TO USER CHAIN JWHEC
 SEND HI PRI REQS TO NEXT BLOCK,
 ALL OTHERS TO JWHEA
 ASSIGN PROGRESS PARAMETER
 REMOVE FROM QJWHE
 SEND HI PRI REQS TO DUTSC
 DUMMY
 SEND ALL TO JWHEL

 PICK AND STAGE MATERIAL

 DURING WORKING HOURS SEND ALL TO
 NEXT BLOCK, ELSE TO JWHT
 RELEASE ONE TRANSACTION FROM JWHEC

 SEND WAREHOUSE REFUSALS TO
 EXCEPTION HANDLING

 SEND BEARER ISSUES TO TERM, ALL
 OTHERS TO NEXT BLOCK

 ASSIGN ISSUE DESTINATION

 ASSIGN ISSUE WEIGHT

 IF LAST TRACTOR TRAIN OF DAY HAS
 DEPARTED, SEND TO NEXT BLOCK, ELSE
 JQUE
 SEND HI PRI REQS TO NEXT BLOCK,
 ALL OTHERS TO JQUE

 ASSIGN PROGRESS PARAMETER

 TRANSFER ALL TO DUTSC

 PLACE TRANSACTIONS ON A USER CHAIN
 AWAITING ON-BASE TRANSPORTATION


```

*****
**          PROVISIONS TRACTOR TRAIN DELIVERY          **
** IN ACTUAL NSD YOKOSUKA OPERATIONS, SPECIAL TRACTOR TRAIN RUNS **
** ARE SCHEDULED TO MEET OPERATIONAL REQUIREMENTS OF THE **
** REQUISITIONER. THESE SPECIAL RUNS ARE TYPICALLY SCHEDULED AFTER **
** NORMALLY SCHEDULED RUNS ARE COMPLETED. THOUGH THE SCHEDULE IS NOT **
** FIXED, IN THE INTEREST OF MAINTAINING ACCURATE THROUGHPUT STATS, **
** A PROVISIONS TRACTOR TRAIN IS SCHEDULED FOR 1600 EACH DAY, WITH **
** A SECOND RUN AT USER DISCRETION. ALL HIGH PRIORITY ISSUES THAT **
** ARRIVE AFTER 1530 ARE ROUTED TO THE DUTY SECTION MODULE. THE **
** PROVISIONS TRACTOR TRAIN SCHEDULE CONTROL SECTION IS PARTITIONED **
** AT THE TOP OF THE MODULE. **
*****
**SCHEDULE CONTROL SECTION*****
*      GENERATE      2400,,1600      GENERATE CONTROL TRANSACTION
*                                     REPRESENTING DAILY TRACTOR
*                                     TRAIN FOR PROVISIONS AT 1600
*      TEST NE      BV$WKDAY,K1,SPLTP      SEND TRAIN TO SPLTP IF WORKDAY,
*                                     ELSE NEXT BLOCK
*      TERMINATE
SPLTP SPLIT      1,LOADP      TERMINATE CONTROL TRANSACTION
*      SPLIT CONTROL TRANSACTION, SEND
*      ONE COPY TO NEXT BLOCK AND ONE TO
*      LOADP
*      ADVANCE      10      DUMMY ADVANCE TO SEPARATE TRAINS
*      TEST L      V$PWGHT,V$PXTRA,LOADP
*                                     IF THE ESTIMATED WEIGHT OF
*                                     ISSUES WAITING FOR THE PTRN
*                                     EXCEEDS PXTRA, SEND TO LOADP,
*                                     ELSE NEXT BLOCK
*      TERMINATE      TERMINATE CONTROL TRANSACTION
*      LOADP UNLINK      PTRNC,PTRNT,ALL,BACK      UNLINK ALL TRANSACTIONS FROM PTRNC
*      TO PTRNT
*      SAVEVALUE      PNUM+,1,XF      COUNT PTRN RUNS
*      TERMINATE      TERMINATE CONTROL TRANSACTION
**OPERATIONS SECTION*****
*      PTRNQ TEST G      V$TIME,1610,PQUE      IF LAST TRACTOR TRAIN OF DAY HAS
*      DEPARTED, SEND TO NEXT BLOCK, ELSE
*      PQUE
*      TEST GE      P1,K4,PQUE      SEND HI PRI REQS TO NEXT BLOCK,
*      ALL OTHERS TO PQUE
*      ASSIGN      3,K16      ASSIGN PROGRESS PARAMETER
*      TRANSFER      ,DUTSC      TRANSFER ALL TO DUTSC
*      PQUE QUEUE      QPTRN,3
*      PLINK LINK      PTRNC,1PH      PLACE TRANSACTIONS ON A USER CHAIN
*      AWAITING ON-BASE TRANSPORTATION
*      PTRNT TEST L      R$PTRN,P5,PTRNE      IF THERE IS SUFFICIENT REMAINING
*      CAPACITY IN PTRN SEND TO PTRNE,
*      ELSE NEXT BLOCK
*      TEST LE      P1,K3,PTRNE      SEND HI PRI ISSUES TO PTRNE, ALL
*      OTHERS TO NEXT BLOCK
*      ADVANCE      1      DUMMY ADVANCE
*      TRANSFER      ,PLINK      TRANSFER ALL BACK TO PLINK
*      PTRNE ENTER      PTRN,PH5
*      DEPART      QPTRN,3
*      ADVANCE      8
*      LEAVE      PTRN,PH5
*      TRANSFER      ,FRTTE      TRANSFER ALL TO FRTTE

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*****
**          TRACTOR TRAIN DELIVERY          **
** CONTROL TRANSACTIONS REPRESENTING NSD-OPERATED TRACTOR TRAINS **
** ARE GENERATED AT 0815,1015,1300,1400. ON WORKDAYS, THE **
** TRANSACTIONS ARE ROUTED TO UNLINK MATERIAL TRANSACTIONS WAITING **
** ON THE VARIOUS WAREHOUSE USER CHAINS. MATERIAL TRANSACTIONS ARE **
** LINKED TO THE ATRNC OR BTRNC, AS APPROPRIATE, TO THE CAPACITY OF **
** THE RESPECTIVE TRAINS REMAINING AT EACH STOP. TRANSACTIONS ARE **
** THEN UNLINKED AND MATERIAL REQUISITIONED BY SRF OR PWC IS SENT TO **
** TERMINATION TO SIMULATE DELIVERY. ALL OTHER ISSUES ARE UNLINKED **
** TO THE FREIGHT TERMINAL MODULE. HIGH PRIORITY TRANSACTIONS THAT **
** MISS THE LAST SCHEDULED TRAIN ARE SENT TO THE DUTY SECTION **
** MODULE. AT USER DISCRETION, AN ADDITIONAL TRAIN MAY BE RUN ON **
** EACH ROUTE AT 1500 TO REDUCE BACKLOG. THE TRACTOR TRAIN SCHEDULE **
** CONTROL SECTION IS PARTIONED AT THE TOP OF THE MODULE. **
*****
**SCHEDULE CONTROL SECTION*****
*
*      GENERATE      2400,,825      GENERATE CONTROL TRANSACTION
*      TRANSFER      ,TRAIN      REPRESENTING 0815 TRAINS
*                                SEND TO WAREHOUSES ON ROUTE
*
*      GENERATE      2400,,1025     GENERATE CONTROL TRANSACTION
*      TRANSFER      ,TRAIN     REPRESENTING 1015 TRAINS
*                                SEND TO WAREHOUSES ON ROUTE
*
*      GENERATE      2400,,1300     GENERATE CONTROL TRANSACTION
*      TRANSFER      ,TRAIN     REPRESENTING 1300 TRAINS
*                                SEND TO WAREHOUSES ON ROUTE
*
*      GENERATE      2400,,1400     GENERATE CONTROL TRANSACTION
*      TRANSFER      ,TRAIN     REPRESENTING 1400 TRAINS
*                                SEND TO WAREHOUSES ON ROUTE
*
*      GENERATE      2400,,1500     GENERATE CONTROL TRANSACTION
*                                REPRESENTING 1500 TRAINS
*      TEST E        BV$WKDAY,K1,TTTRM ON WORKDAYS, SEND TO NEXT BLOCK
*      SPLIT          1,LATEB          SPLIT CONTROL TRANSACTION
*      TEST L        V$AWGHT,V$AXTRA,LOADA
*
*                                IF THE ESTIMATED WEIGHT OF
*                                ISSUES WAITING FOR THE ATRN
*                                EXCEEDS AXTRA, SEND TO LOADA,
*                                ELSE NEXT BLOCK
*      TERMINATE      TERMINATE CONTROL TRANSACTION
*
*      LATEB TEST L    V$BWGHT,V$BXTRA,LOADB
*                                IF THE ESTIMATED WEIGHT OF
*                                ISSUES WAITING FOR THE BTRN
*                                EXCEEDS BXTRA, SEND TO LOADB,
*                                ELSE NEXT BLOCK
*      TERMINATE      TERMINATE CONTROL TRANSACTION
*
*      TRAIN TEST NE   BV$WKDAY,K1,LOAD SEND TRAIN TO LOAD IF WORKDAY
*      TTTRM TERMINATE TERMINATE CONTROL TRANSACTION
*
*      LOAD SPLIT      1,LOADB      SPLIT CONTROL TRANSACTION, SEND
*                                ONE COPY TO NEXT BLOCK AND ONE TO
*                                LOADB

```

```

**LOADING SECTION *****
*
*  LOADA UNLINK      MCH,ATEST,ALL,BACK  UNLINK ALL TRANSACTIONS FROM MCH
*                                     TO ATRNT
*  UNLINK            FCH,ATEST,ALL,BACK  UNLINK ALL TRANSACTIONS FROM FCH
*                                     TO ATRNT
*  ADVANCE           17                  SIMULATE TRANSPORTATION TIME TO
*                                     F WAREHOUSE AREA
*  UNLINK            MCH,ATRNT,ALL,BACK  UNLINK ALL TRANSACTIONS FROM MCH
*                                     TO ATRNT
*  UNLINK            FCH,ATRNT,ALL,BACK  UNLINK ALL TRANSACTIONS FROM FCH
*                                     TO ATRNT
*  ADVANCE           32                  SIMULATE TRANSPORTATION TIME TO
*                                     PWC/SRF
*  UNLINK            ATRNC,ATRNL,ALL,BACK UNLINK ALL TRANSACTIONS FROM ATRNC
*                                     TO ATRNL
*  SAVEVALUE         ANUM+,1,XF          COUNT ATRN RUNS
*  TERMINATE                                     TERMINATE CONTROL TRANSACTION
*
*  LOADB UNLINK      JCH,BTEST,ALL,BACK  UNLINK ALL TRANSACTIONS FROM JCH
*                                     TO BTEST
*  UNLINK            BCH,BTEST,ALL,BACK  UNLINK ALL TRANSACTIONS FROM BCH
*                                     TO BTEST
*  UNLINK            ACH,BTEST,ALL,BACK  UNLINK ALL TRANSACTIONS FROM ACH
*                                     TO BTEST
*  ADVANCE           8                   SIMULATE TRANSPORTATION TIME TO -
*                                     J WAREHOUSE AREA
*  UNLINK            JCH,BTRNT,ALL,BACK  UNLINK ALL TRANSACTIONS FROM JCH
*                                     TO BTRNT
*  ADVANCE           3                   SIMULATE TRANSPORTATION TIME TO
*                                     B WAREHOUSE AREA
*  UNLINK            BCH,BTRNT,ALL,BACK  UNLINK ALL TRANSACTIONS FROM BCH
*                                     TO BTRNT
*  ADVANCE           10                  SIMULATE TRANSPORTATION TIME TO
*                                     A WAREHOUSE AREA
*  UNLINK            ACH,BTRNT,ALL,BACK  UNLINK ALL TRANSACTIONS FROM ACH
*                                     TO BTRNT
*  ADVANCE           17                  SIMULATE TRANSPORTATION TIME TO
*                                     PWC/SRF
*  UNLINK            BTRNC,BTRNL,ALL,BACK UNLINK ALL TRANSACTIONS FROM BTRNC
*                                     TO BTRNL
*  SAVEVALUE         BNUM+,1,XF          COUNT BTRN RUNS
*  TERMINATE                                     TERMINATE CONTROL TRANSACTION

```

OPERATIONS SECTION - A TRAIN ROUTE***

* ATEST TEST G P1,K1,ASEND SEND IPG3 ISSUES TO ASEND, ALL
 * OTHERS TO NEXT BLOCK
 * ATRNT TEST L R\$ATRNL,P5,ATRNE IF THERE IS SUFFICIENT REMAINING
 * CAPACITY IN ATRN SEND TO ATRNE,
 * ELSE NEXT BLOCK
 * ASEND ADVANCE 1 DUMMY ADVANCE
 * TRANSFER 1 FN,FTHFR TRANSFER ALL BACK TO WAREHOUSE
 * ATRNE ENTER ATRN,PH5
 * DEPART QATRNL,3
 * LINK ATRNC,1PH LINK TO ATRNC
 * ATRNL LEAVE ATRN,PH5
 * TRANSFER ,TMTST TRANSFER ALL TO TMTST

OPERATIONS SECTION - B TRAIN ROUTE***

* BTEST TEST G P1,K1,BSEND SEND IPG3 ISSUES TO BSEND, ALL
 * OTHERS TO NEXT BLOCK
 * BTRNT TEST L R\$BTRNL,P5,BTRNE IF THERE IS SUFFICIENT REMAINING
 * CAPACITY IN BTRN SEND TO BTRNE,
 * ELSE NEXT BLOCK
 * BSEND ADVANCE 1 DUMMY ADVANCE
 * TRANSFER 1 FN,FTHFV TRANSFER ALL BACK TO WAREHOUSE
 * BTRNE ENTER BTRN,PH5
 * DEPART QBTRNL,3
 * LINK BTRNC,1PH LINK TO BTRNC
 * BTRNL LEAVE BTRN,PH5

TEST FOR PWC/PRF DELIVERY***

* TMTST TEST NE P4,K1,TERM SEND ISSUES FOR SRF AND PWC TO
 * TERM TO SIMULATE DELIVERY BY
 * TRACTOR TRAIN, ALL OTHERS TO NEXT
 * ADVANCE 17 SIMULATE TRANSPORTATION TIME TO
 * FREIGHT TERMINAL


```

*****
**          FREIGHT TERMINAL MODULE          **
** TRANSACTIONS REPRESENTING MATERIAL ARE TESTED FOR PACK TYPE **
** REQUIRED AND SENT TO LIGHT OR HEAVY PACK LINES AS APPROPRIATE **
** (PARCEL POST PACKS GO TO THE LIGHT PACK LINE). PACK TIMES **
** IN THE LIGHT PACK LINE ARE OBTAINED FROM FUNCTION FTWSV. AFTER **
** PACKING IS COMPLETED, ALL ISSUES ARE ROUTED TO THE TERMINATION **
** MODULE AS AVAILABLE FOR SHIPMENT. MATERIAL RECEIVED FROM TRACTOR **
** TRAINS THAT DOES NOT REQUIRE PACKING IS SENT DIRECTLY TO THE **
** TERMINATION MODULE AS AVAILABLE FOR SHIPMENT.          **
*****
*****
*
* FRTTE TEST E      P4,K2,TERM      SEND ISSUES AVAILABLE FOR SHIPMENT
*                               SHIPMENT TO TERM, ALL OTHERS TO
*                               NEXT BLOCK
*
*      TRANSFER      .V$LITEP,,LITPQ      TRANSFER ISSUES REQUIRING LIGHT OR
*                               PARCEL POST PACK TO LITEQ, ALL
*                               OTHERS TO NEXT BLOCK
*
**HEAVY PACK OPERATIONS SECTION*****
*
* HVYPQ QUEUE      OHVYP,3
*   TEST E      BV$LUNCH,K0,HVYPL      SEND ALL TO HVYPL DURING LUNCH,
*                               ELSE NEXT BLOCK
*   TEST E      BV$WORKH,K1,HVYPT      SEND ALL TO NEXT BLOCK DURING
*                               WORKING HOURS, ELSE SEND TO HVYPT
*   TEST E      R$HVYP,K0,HVYPE      SEND ALL TO HVYPE IF STORAGE IS
*                               NOT FULL, ELSE NEXT BLOCK
* HVYPL LINK      HVYPC,1PH      LINK TO USER CHAIN HVYPC
* HVYPT TEST GE      P1,K4,HVYPA      SEND HI PRI REQS TO NEXT BLOCK,
*                               ALL OTHERS TO HVYPA
*   ASSIGN      3,K22      ASSIGN PROGRESS PARAMETER
*   DEPART      QHVYP,3      REMOVE FROM QHVYP
*   TRANSFER      ,DUTSC      SEND HI PRI REQS TO DUTSC
* HVYPA ADVANCE      1      DUMMY
*   TRANSFER      ,HVYPL      SEND ALL TO HVYPL
* HVYPE ENTER      HVYP
*   DEPART      QHVYP,3
* HVYP ADVANCE      V$HVYPS      PACK MATERIAL REQUIRING HEAVY PACK
*   LEAVE      HVYP
*   TEST E      BV$WORKH,K1,HVYTR      DURING WORKING HOURS SEND ALL TO
*                               NEXT BLOCK, ELSE TO HVYTR
*   UNLINK      HVYPC,HVYPE,1,BACK      RELEASE ONE TRANSACTION FROM HVYPC
* HVYTR TRANSFER      ,TERM

```

LIGHT AND PARCEL POST PACK OPERATIONS SECTION***

*	LITPQ	QUEUE	QLITP,3	
		TEST E	BV\$LUNCH,K0,LITPL	SEND ALL TO LITPL DURING LUNCH, ELSE NEXT BLOCK
*		TEST E	BV\$WORKH,K1,LITPT	SEND ALL TO NEXT BLOCK DURING WORKING HOURS, ELSE SEND TO LITPT
*		TEST E	R\$LITP,K0,LITPE	SEND ALL TO LITPE IF STORAGE IS NOT FULL, ELSE NEXT BLOCK
	LITPL	LINK	LITPC,1PH	LINK TO USER CHAIN LITPC
*	LITPT	TEST GE	P1,K4,LITPA	SEND HI PRI REQS TO NEXT BLOCK, ALL OTHERS TO LITPA
		ASSIGN	3,K23	ASSIGN PROGRESS PARAMETER
		DEPART	QLITP,3	REMOVE FROM QLITP
		TRANSFER	,DUTSC	SEND HI PRI REQS TO DUTSC
	LITPA	ADVANCE	1	DUMMY
		TRANSFER	,LITPL	SEND ALL TO LITPL
	LITPE	ENTER	LITP	
		DEPART	QLITP,3	
*	LITP	ADVANCE	V\$LITPS	PACK MATERIAL REQUIRING LIGHT OR PARCEL POST PACK
		LEAVE	LITP	
*		TEST E	BV\$WORKH,K1,LITTR	DURING WORKING HOURS SEND ALL TO NEXT BLOCK, ELSE TO LITTR
		UNLINK	LITPC,LITPE,1,BACK	RELEASE ONE TRANSACTION FROM LITPC
	LITTR	TRANSFER	,TERM	

```

*****
**                                DUTY SECTION                                **
** THE SCHEDULE CONTROL SECTION GENERATES A CONTROL TRANSACTION AT **
** AT THE START OF EACH DAY TO CONTROL DUTY SECTION OPERATIONS. ON **
** WORKDAYS, ADVANCE BLOCKS MOVE THE TRANSACTION THRU THE SCHEDULE **
** CONTROL SECTION. AT APPROPRIATE TIMES, THE STORAGE REPRESENTING **
** THE DUTY SECTION IS OPENED AND CLOSED AND TRANSACTIONS ARE LINKED **
** TO AND UNLINKED FROM USER CHAINS WITHIN THE OPERATING SECTION. **
*****
** THE DUTY SECTION OPERATIONS SECTION SIMULATES NSD LATE SHIFT AND **
** DUTY SECTION OPERATIONS. THE DUTY STORAGE HAS A CAPACITY OF TWO **
** MATCHING THE NUMBER OF PERSONNEL ACTUALLY AVAILABLE IN BOTH THE **
** LATE SHIFT AND THE DUTY SECTION TO PROCESS ISSUES. TRANSACTIONS **
** ENTERING THE MODULE ARE SPLIT INTO THREE TRANSACTIONS TO RESTORE **
** THE ACTUAL DEMAND LEVEL AND ADVANCED TO THE POINT OF PROGRESS **
** INDICATED BY P3. TRANSACTIONS TRANSFERRED TO THE DUTY SECTION **
** BUT NOT PROCESSED ARE TRANSFERRED BACK TO THEIR MODULE OF ORIGIN. **
** COMPLETED ISSUES ARE TERMINATED AS APPROPRIATE (NIS OR AVAILABLE **
** FOR SHIPMENT). NOTE: BECAUSE MOST HIGH PRIORITY PERISHABLE **
** PROVISIONS ISSUES MADE OUTSIDE OF NORMAL WORKING HOURS BY NSD **
** ARE FOR FLEET ACTIVITIES, YOKOHAMA COLD STORAGE REQUISITIONS ARE **
** ROUTED INSTEAD TO YOKOSUKA COLD STORAGE. **
*****
**SCHEDULE CONTROL SECTION*****
*
*      GENERATE      2400,0,1      GENERATE CONTROL TRANSACTION
*
*      TEST E      BV$WKDAY,K1,DTEND      SEND TO DTEND IF SAT/SUN ELSE NEXT
*                                     BLOCK
*      ADVANCE      800      ADVANCE TO 0801
*      UNLINK      DUTYC,DUTYD,ALL,BACK      UNLINK TRANSACTIONS NOT PROCESSED
*                                     BY THE DUTY SECTION
*      ADVANCE      875      ADVANCE TO 1646
*      UNLINK      DUTYC,DUTYS,2,BACK      UNLINK 2 TRANSACTIONS FOR DUTY
*                                     SECTION PROCESSING
*      DTEND TERMINATE      TERMINATE CONTROL TRANSACTION

```

OPERATIONS SECTION***

DUTSC	QUEUE	DUTYQ	
*	TEST NE	BV\$OPEN,K1,DUTYL	IF OUTSIDE WORKING HOURS, SEND
			TO NEXT BLOCK, ELSE DUTYL
*	TEST E	R\$DUTY,K0,DUTYS	IF DUTY STORAGE IS NOT FULL, SEND
			TO DUTYS, ELSE NEXT BLOCK
DUTYL	LINK	DUTYC,1PH	LINK TO USER CHAIN DUTYC
DUTYD	DEPART	DUTYQ	
	TRANSFER	FN,FTHIR	TRANSFER ALL TRANSACTIONS NOT
*			PROCESSED BY THE DUTY SECTION BACK
*			TO THE POINT OF PROGRESS INDICATED
*			BY P3
DUTYS	SPLIT	2,OSPLT	SPLIT EACH TRANSACTION INTO THREE
	TRANSFER	,DUTYE	TRANSFER ALL TO DUTYE
OSPLT	QUEUE	DUTYQ	ADD SPLIT TRANSACTIONS TO QUEUE
DUTYE	ENTER	DUTY	
	DEPART	DUTYQ	
	TRANSFER	FN,FTHON	TRANSFER ALL TRANSACTIONS TO BE
*			WORKED BY THE DUTY SECTION TO
*			THE POINT OF PROGRESS INDICATED BY
*			P3
PZERO	ADVANCE	FN\$FELEV	STOCK CHECK ALL REQUISITIONS
	TRANSFER	.V\$GROSS,,RTE	TRANSFER IN STOCK REQS TO RTE,
*			NIS REQS TO NEXT BLOCK
	ASSIGN	3,K2	TAG NIS REQS
	LEAVE	DUTY	
	TRANSFER	,DUTTR	
PONE	TEST NE	P6,K2,RTE	SEND IN STOCK REQS TO RTE, ALL
*			OTHERS TO NEXT BLOCK
	ADVANCE	FN\$FELEV	PERFORM STOCK CHECK
*	TEST E	P6,K1,RTE	SEND NIS REQS TO NEXT BLOCK, ALL
			OTHERS TO NEXT BLOCK
	ASSIGN	3,K2	TAG NIS REQS
	LEAVE	DUTY	
	TRANSFER	,DUTTR	
RTE	ADVANCE	FN\$FTWEL	REMOTE TERMINAL ENTRY OF REQS
	TRANSFER	.V\$NOTEX,,WHEAS	SEND DEMAND EXCEPTIONS TO NEXT
*			BLOCK, ALL OTHERS TO WHEAS
PTHRE	ADVANCE	FN\$FFRTN	PROCESS DEMAND EXCEPTIONS
WHEAS	ASSIGN	2,FN\$FTWO	ASSIGN WAREHOUSE LOCATION
WRTR	TRANSFER	.V\$NOTWR,,PFOUR	SEND WAREHOUSE REFUSALS TO NEXT
*			BLOCK, ALL OTHERS TO PFOUR
	ASSIGN	8,K1	TAG WAREHOUSE REFUSALS
PFOUR	TEST E	P2,K1,SORT	SEND YOKOHAMA ISSUE DOCS TO NEXT
*			BLOCK, ALL OTHERS TO SORT
	ASSIGN	2,K2	REASSIGN YOKOHAMA REQS TO YOKOSUKA
*			COLD STORAGE
SORT	ADVANCE	FN\$FSXTN	MARK,BURST ISSUE DOCS
PSIX	ADVANCE	FN\$FTHSV	DRIVE TO WAREHOUSE LOCATION
PEIGH	ADVANCE	FN\$FSVTN	MAKE PICK
	TEST E	P8,K1,TURN	SEND WAREHOUSE REFUSALS TO NEXT
*			BLOCK, ALL OTHERS TO TURN
	ASSIGN	3,K25	TAG WAREHOUSE REFUSALS
	LEAVE	DUTY	
	TRANSFER	,DUTTR	
TURN	TEST E	BV\$BEAR,K1,DESTA	SEND BEARER ISSUES TO NEXT BLOCK,
*			ALL OTHERS TO DESTA
	ASSIGN	3,K24	TAG BWT ISSUES
	LEAVE	DUTY	
	TRANSFER	,DUTTR	
DESTA	ASSIGN	4,FN\$FTHRE	ASSIGN ISSUE DESTINATION TO P4
PSXTN	ADVANCE	FN\$FTHEI	DRIVE TO FREIGHT TERMINAL
	TEST E	P4,K2,SHIP	SEND ISSUES REQUIRING PACKING TO
*			NEXT BLOCK, ALL OTHERS TO SHIP
	TRANSFER	.V\$LITEP,,PTWTH	SEND ISSUES REQUIRING HEAVY PACK
*			TO NEXT BLOCK, ALL OTHERS TO PTWTH
PTWTW	ADVANCE	FN\$FTWSX	HEAVY PACK
	TRANSFER	,SHIP	SEND ALL TO SHIP

PTWTH	ADVANCE	FN\$FTWSV	LIGHT/PARCEL POST PACK
SHIP	ASSIGN	3,K24	TAG AS AVAILABLE FOR SHIPMENT
	LEAVE	DUTY	
DUTTR	ADVANCE		DUMMY ADVANCE
	TEST E	BV\$THREE,K1,SEND	
	UNLINK	DUTYC,DUTYS,1,BACK	
*			UNLINK ONE TRANSACTION FROM DUTYC
*			FOR EVERY THREE LEAVING
SEND	TRANSFER	FN,FTHIR	SEND ISSUES TO LOCATION DETERMINED
*			BY PROGRESS PARAMETER

```

*****
**          TERMINATION MODULE          **
** IN THE TABLE DEFINITION SECTION, FREQUENCY DISTRIBUTION TABLES **
** ARE DEFINED TO MEASURE THROUGHPUT TIME FOR ALL ISSUES (ALL) AND **
** BY ISSUE PRIORITY GROUP (IPGON,IPGTW,IPGTH). TABULATION OF **
** ISSUES IN APPROPRIATE TABLES IS MANAGED BY ROUTING TRANSACTIONS **
** BY PARAMETER ONE VALUES. RAW COUNTS ARE MADE ON NIS AND **
** WAREHOUSE REFUSAL TRANSACTIONS. **
*****
*
**TABLE DEFINITIONS*****
*
ALL TABLE M1,0,1200,22
IPGON TABLE M1,0,1200,16
IPGTW TABLE M1,0,1200,16
IPGTH TABLE M1,0,1200,22
*
**ISSUE COUNT, TABULATION AND TERMINATION*****
*
TERM SPLIT 2,ALLCT SPLIT EACH TRANSACTION INTO 3 TO
* RESTORE DEMAND LEVEL
ALLCT TABULATE ALL ENTER ALL ISSUES INTO TABLE ALL
TEST NE P1,K1,TMTHR SEND IPG3 TRANSACTIONS TO TMTHR,
* ALL OTHERS TO NEXT BLOCK
TEST G P1,K5,TMTWO SEND IPG2 TRANSACTIONS TO TMTWO,
* ALL OTHERS TO NEXT BLOCK
TMONE TABULATE IPGON ENTER IPG1 TRANSACTIONS INTO
* TABLE IPGON
TERMINATE IPG1 TRANSACTIONS
TMTWO TABULATE IPGTW ENTER IPG2 TRANSACTIONS INTO
* TABLE IPGTW
TERMINATE IPG2 TRANSACTIONS
TMTHR TABULATE IPGTH ENTER IPG3 TRANSACTIONS INTO
* TABLE IPGTH
TERMINATE IPG3 TRANSACTIONS
*
NISTM SPLIT 2,DTNIS
DTNIS SAVEVALUE NISCT+,1,XF COUNT NIS REQS
* TERMINATE NIS REQS
WRTRM SPLIT 2,DTWR
DTWR SAVEVALUE WRCT+,1,XF COUNT WAREHOUSE REFUSALS
* TERMINATE WAREHOUSE REFUSALS

```

```

*****
**                               SIMULATION RUN CONTROL                               **
** THE FIRST START STATEMENT AND THE FOLLOWING RESET STATEMENT ARE **
** USED TO BRING THE MODEL TO STEADY STATE, THAT IS, TO FILL IT **
** WITH TRANSACTIONS SO THAT THE SIMULATION DOES NOT START WITH AN **
** EMPTY SUPPLY DEPOT. THE INITIAL STATEMENT RESETS ALL SAVEVALUES **
** USED TO GATHER STATISTICS DURING THE SIMULATION TO ZERO. THE **
** FINAL START STATEMENT REFERS TO FIRST TERMINATE STATEMENT IN THE **
** MASTER SCHEDULE CONTROL MODULE, TERMINATING THE SIMULATION WHEN **
** THE 4TH TRANSACTIONS ENTERS THAT BLOCK. **
*****

```

```

*
  START      2,NP
  RESET
  INITIAL    XFSREOCT,0/XFSRION,0/XFSRITW,0/XFSRITH,0
  INITIAL    XFSANUM,0/XFSENUM,0/XFSPNUM,0
  INITIAL    XFSNISCT,0/XFSWRCT,0
  START      4,,1
  END

```

```

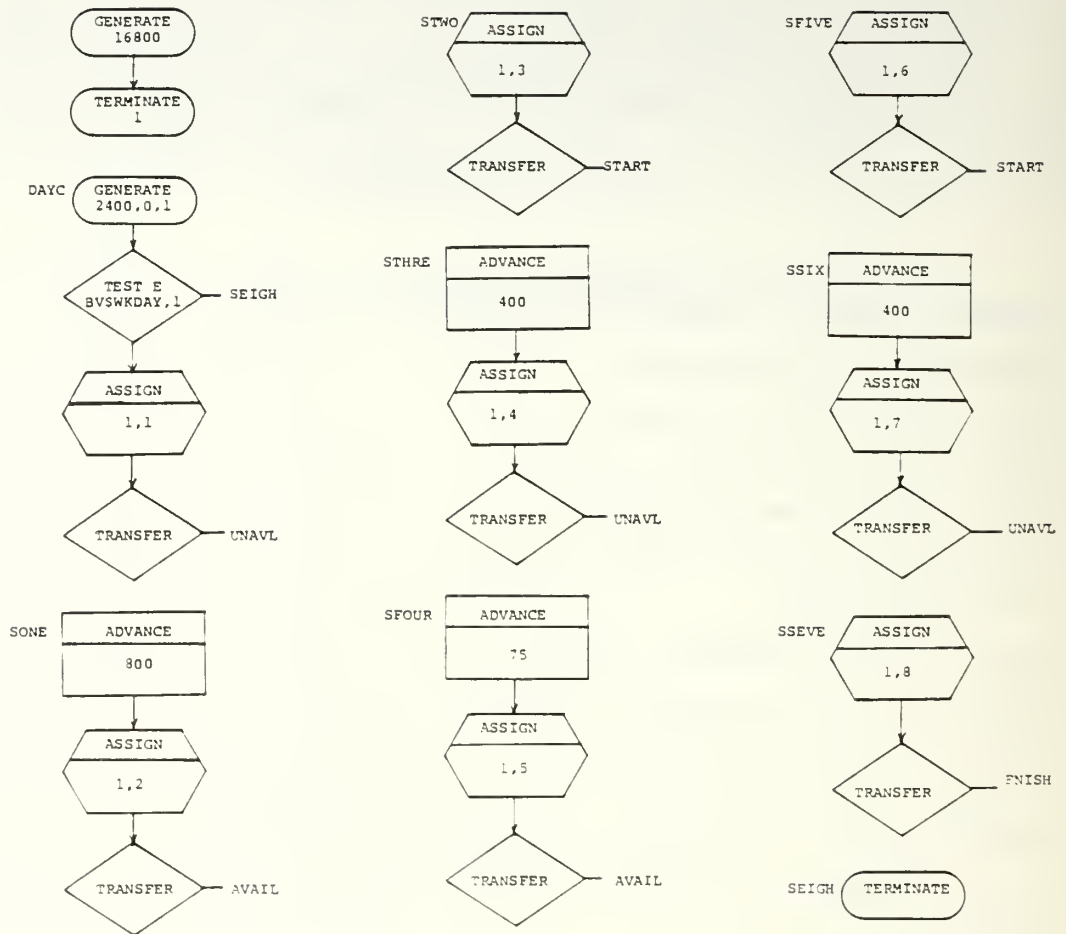
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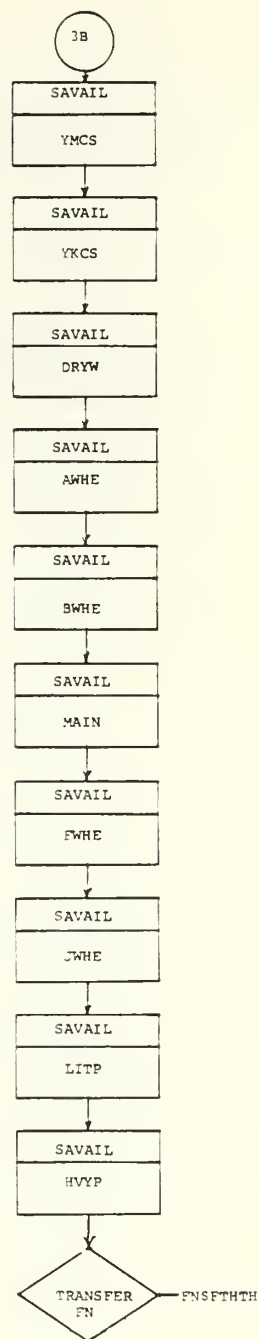
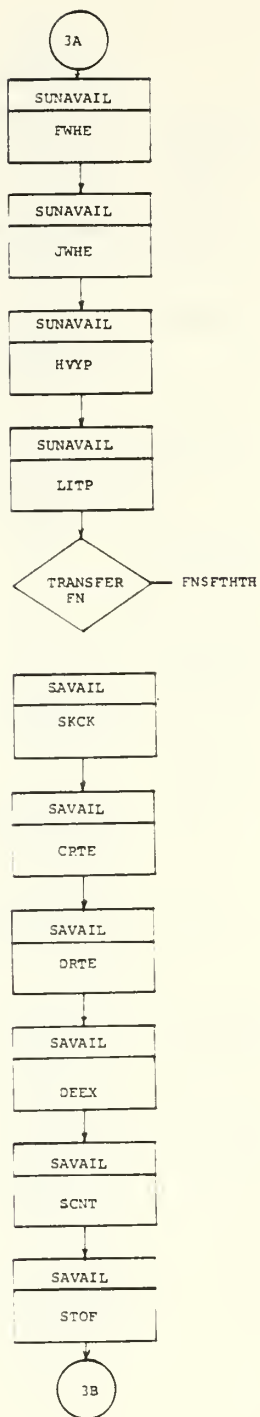
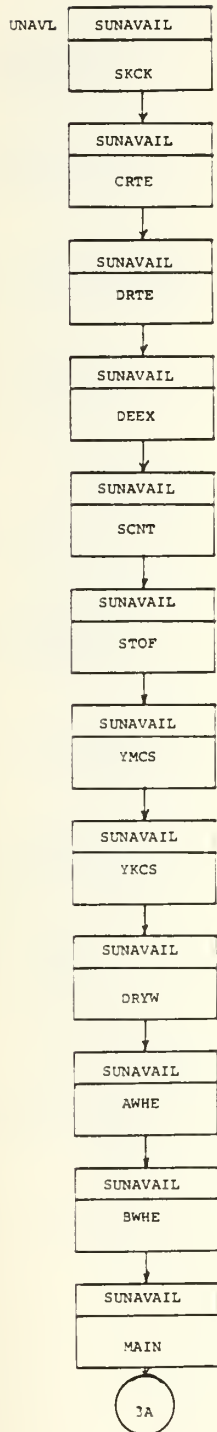
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APPENDIX B
GPSS BLOCK DIAGRAM

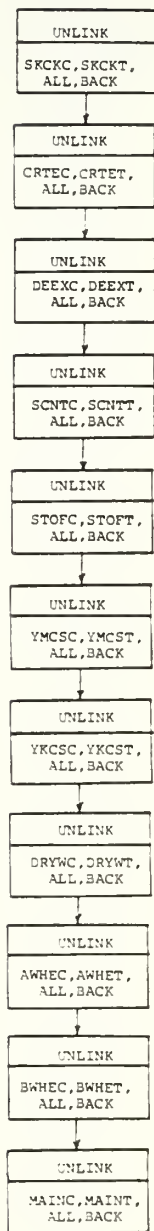
TABLE OF CONTENTS

Master Schedule Control Module	100
Storage Control Module	101
User Chain Control Module.	102
Requisition Generation Module.	103
Requisition Receipt Module	104
NSD Remote Terminal Entry Module	105
CPU Tests Module	105
Printer Queue Handling Module.	106
Demand Exception Handling Module	107
Warehouse Assignment Module.	107
Storage Control/Storage Office Module.	108
Yokohama Issue Document Delivery Module.	109
Bicycle Messenger Delivery Module.	109
Warehouses Module.	110
Provisions Tractor Train Delivery Module	118
Tractor Train Delivery Module.	119
Freight Terminal Module.	121
Duty Section Module.	122
Termination Module	124



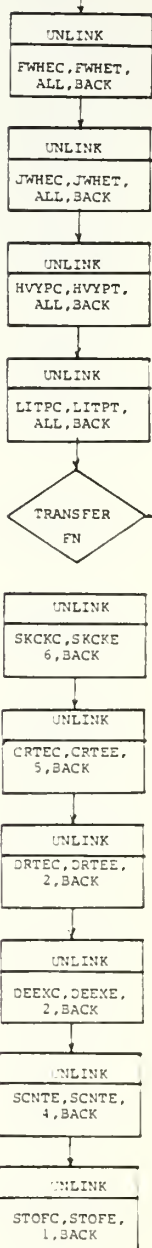


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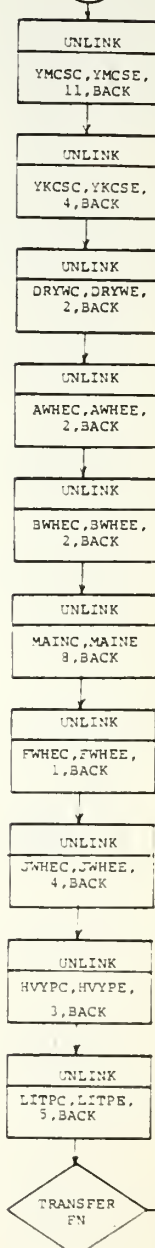
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4A

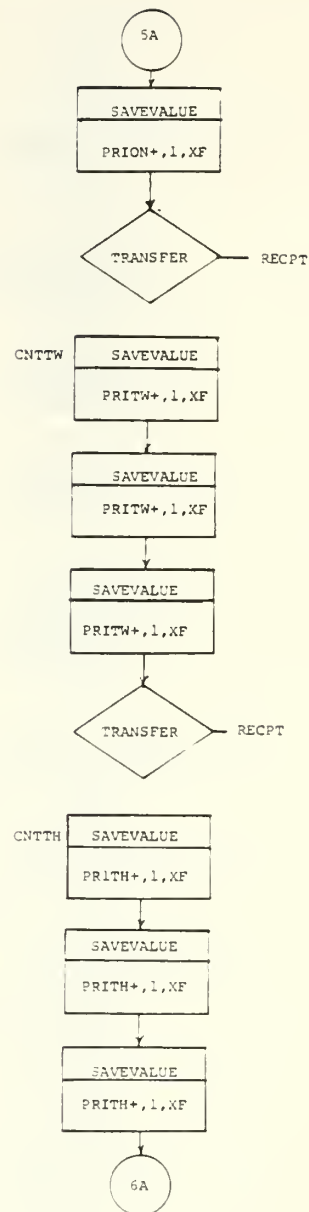
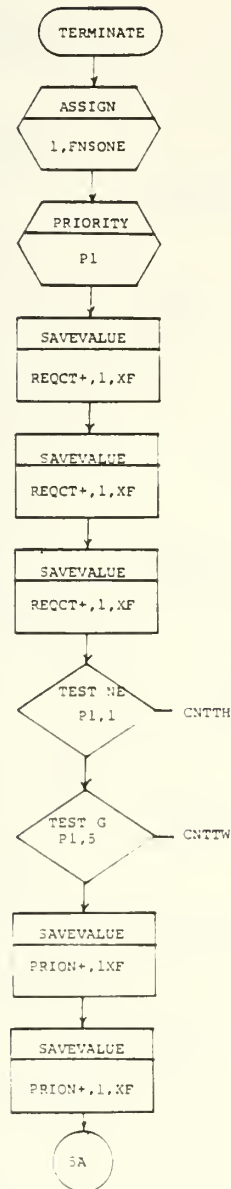
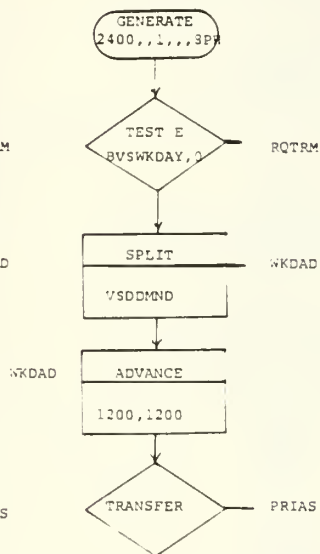
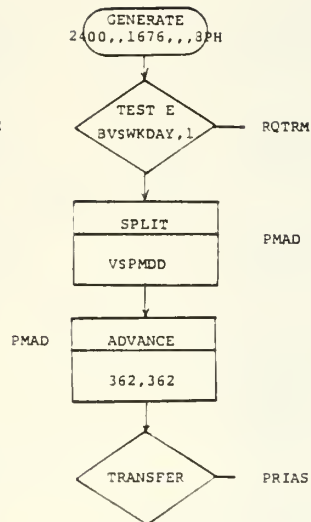
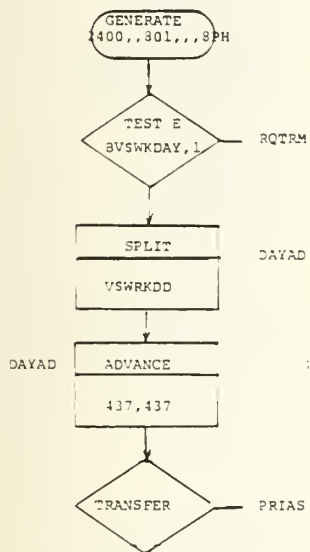
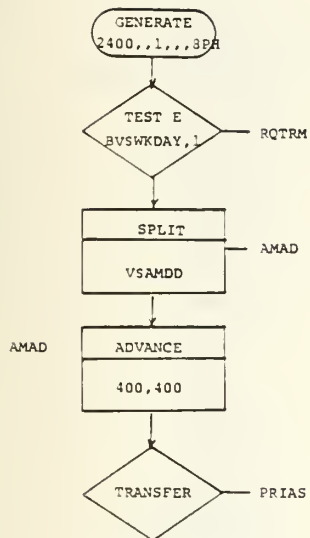


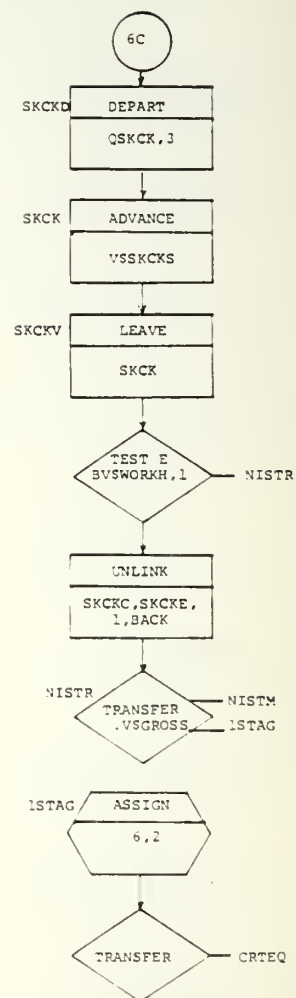
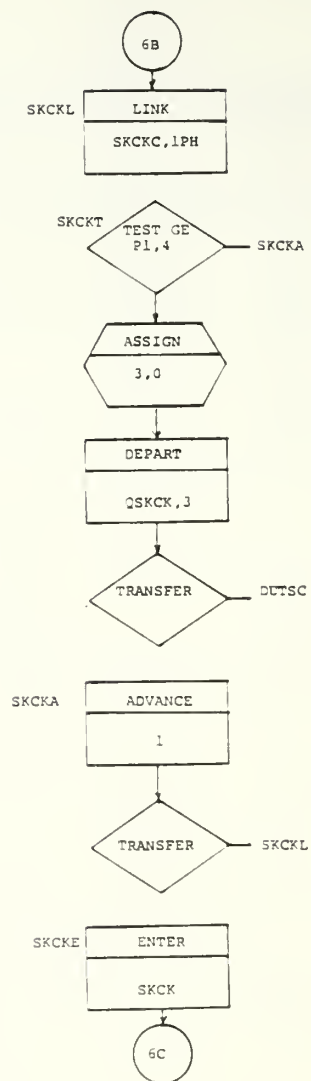
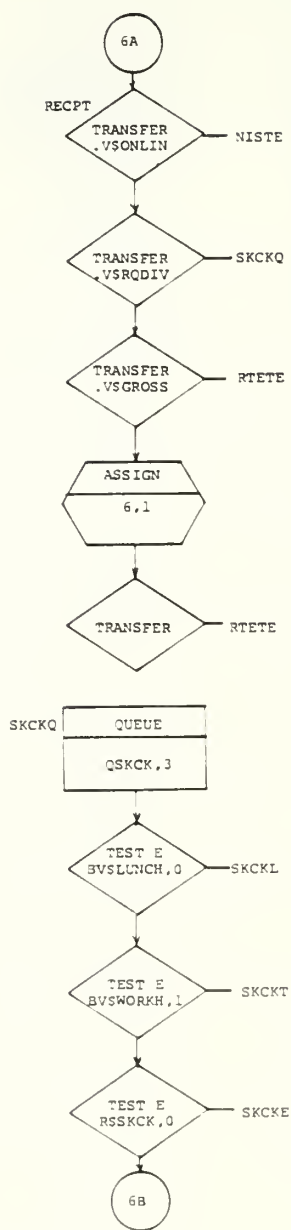
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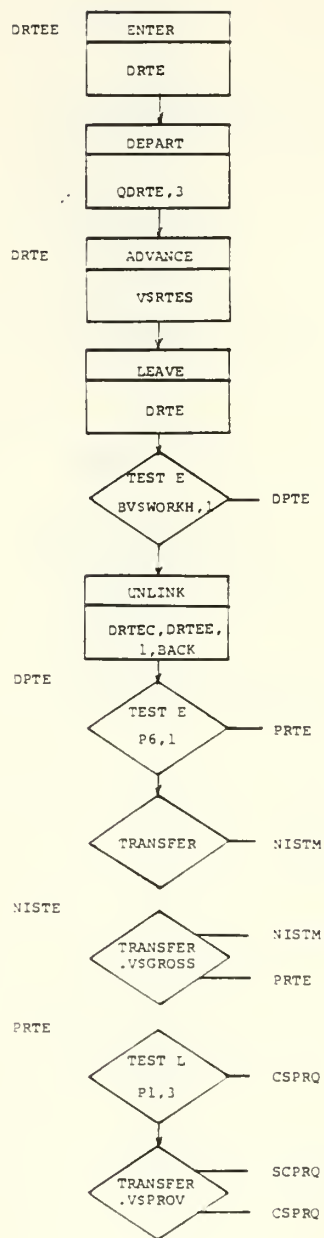
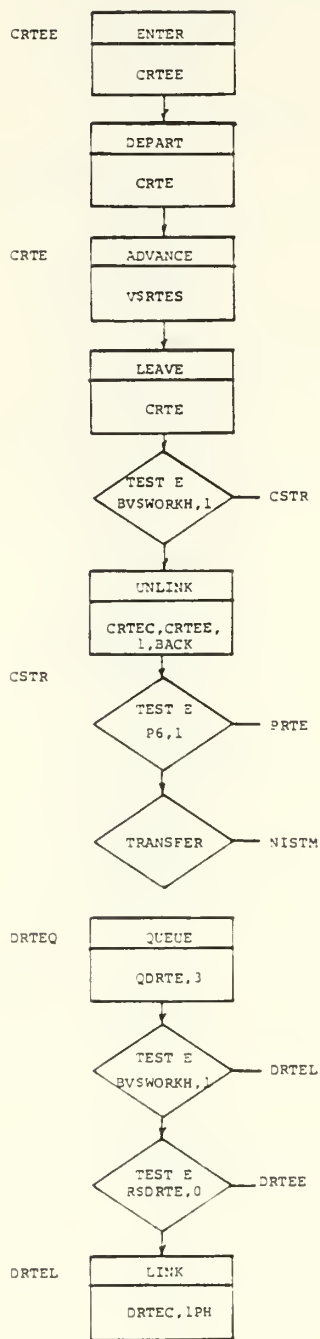
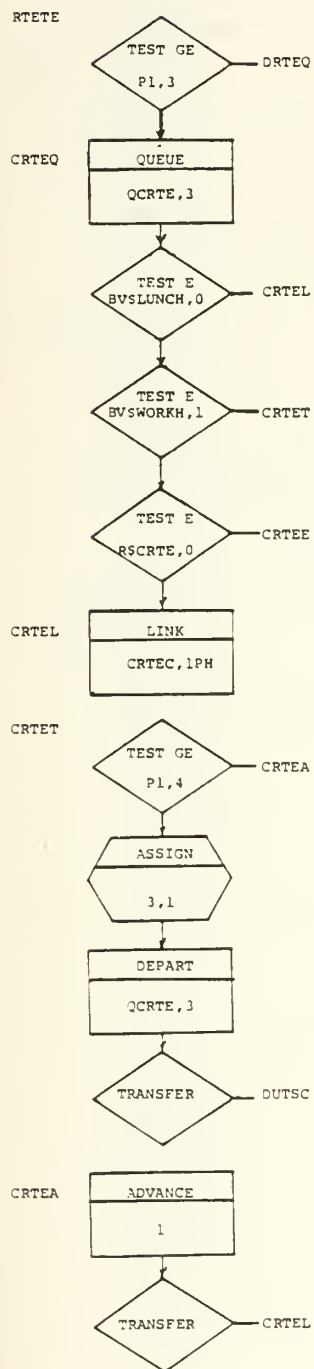
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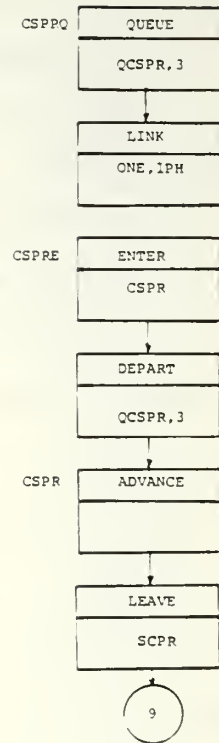
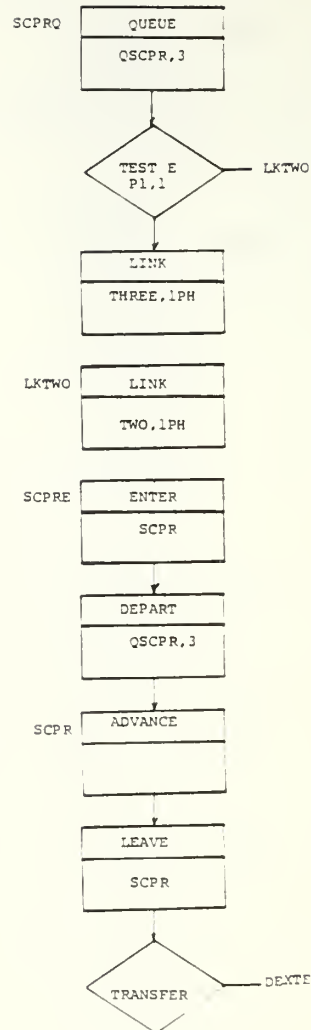
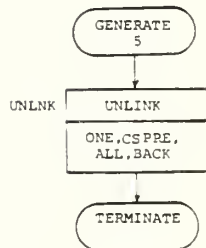
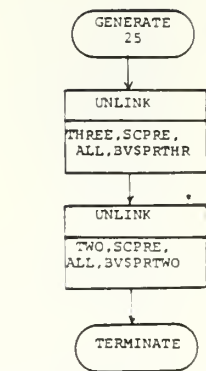


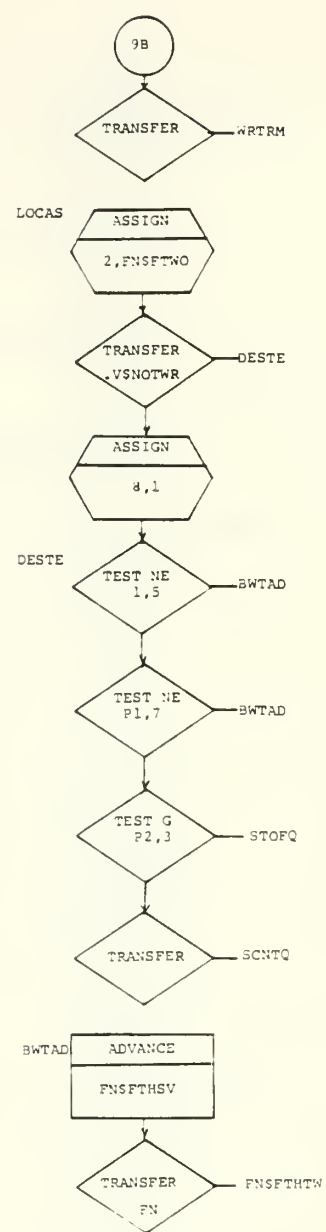
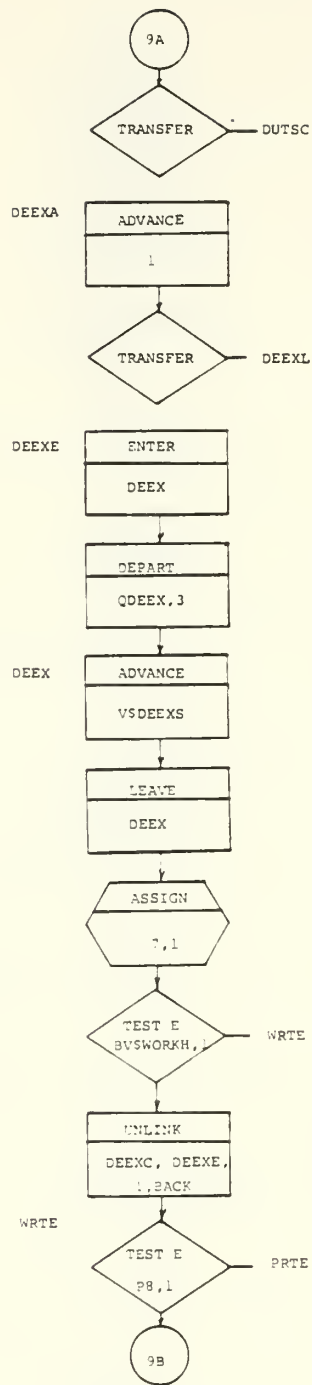
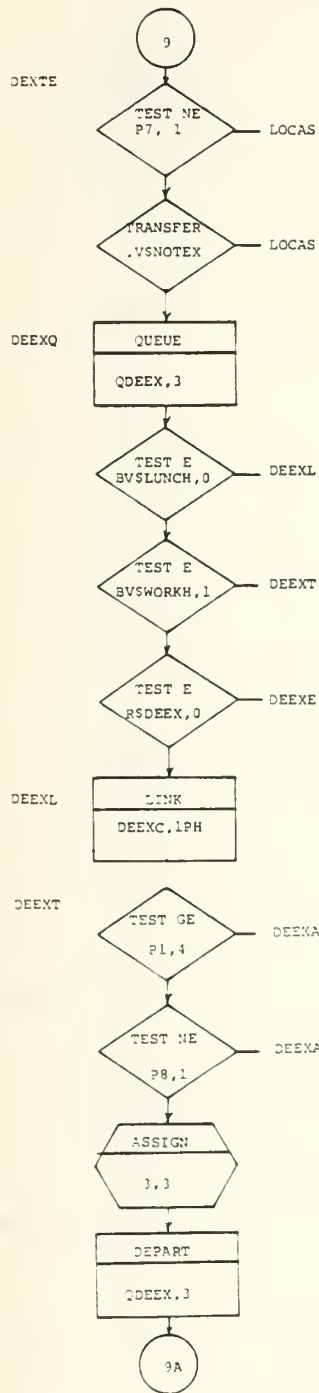
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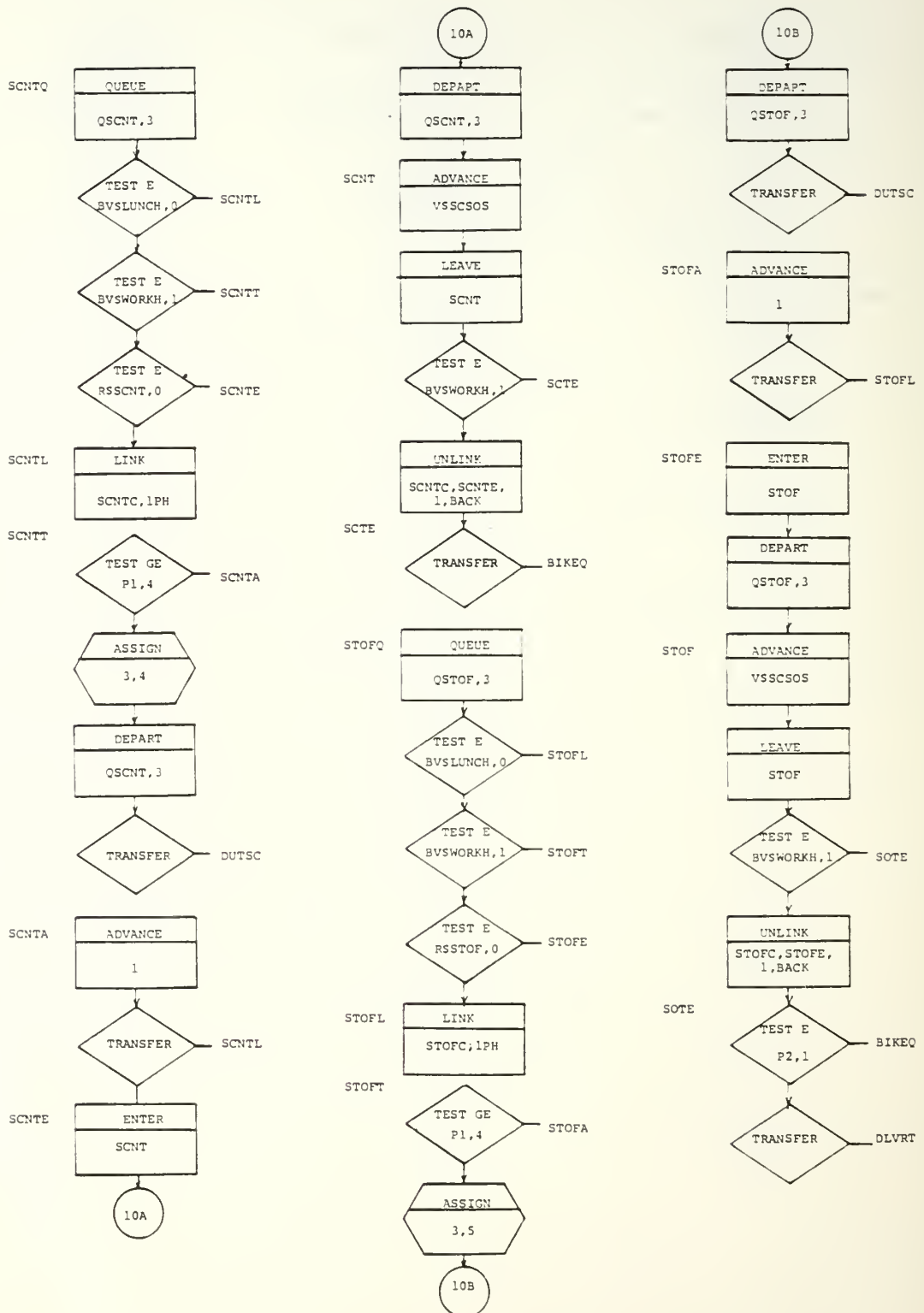


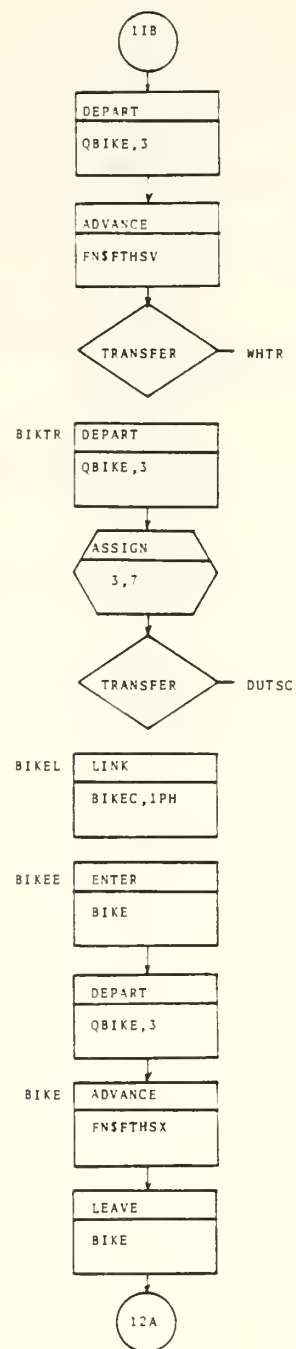
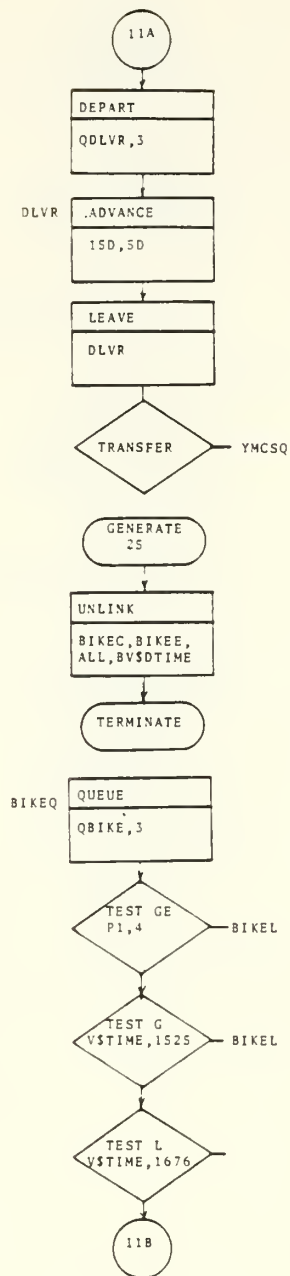
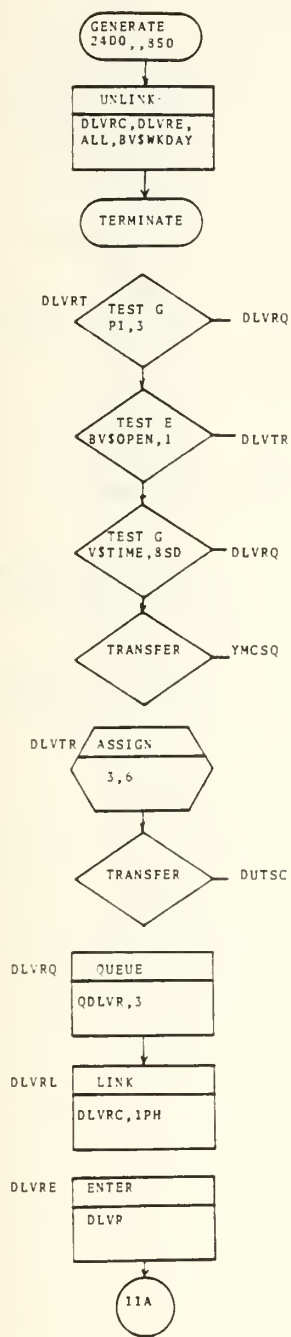


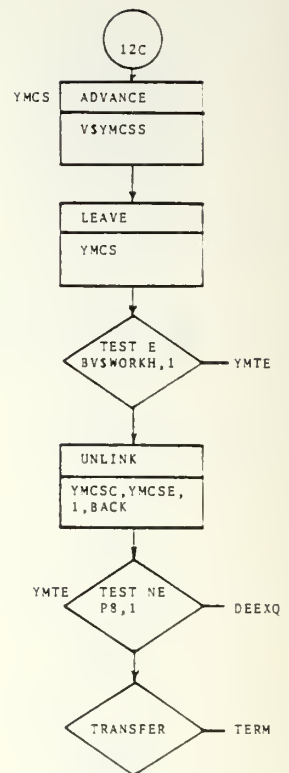
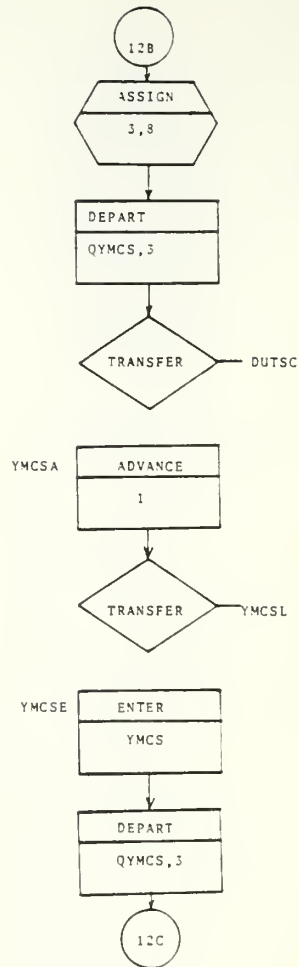
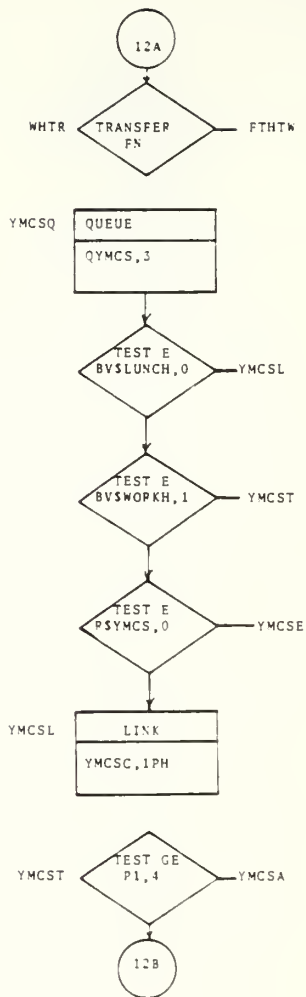


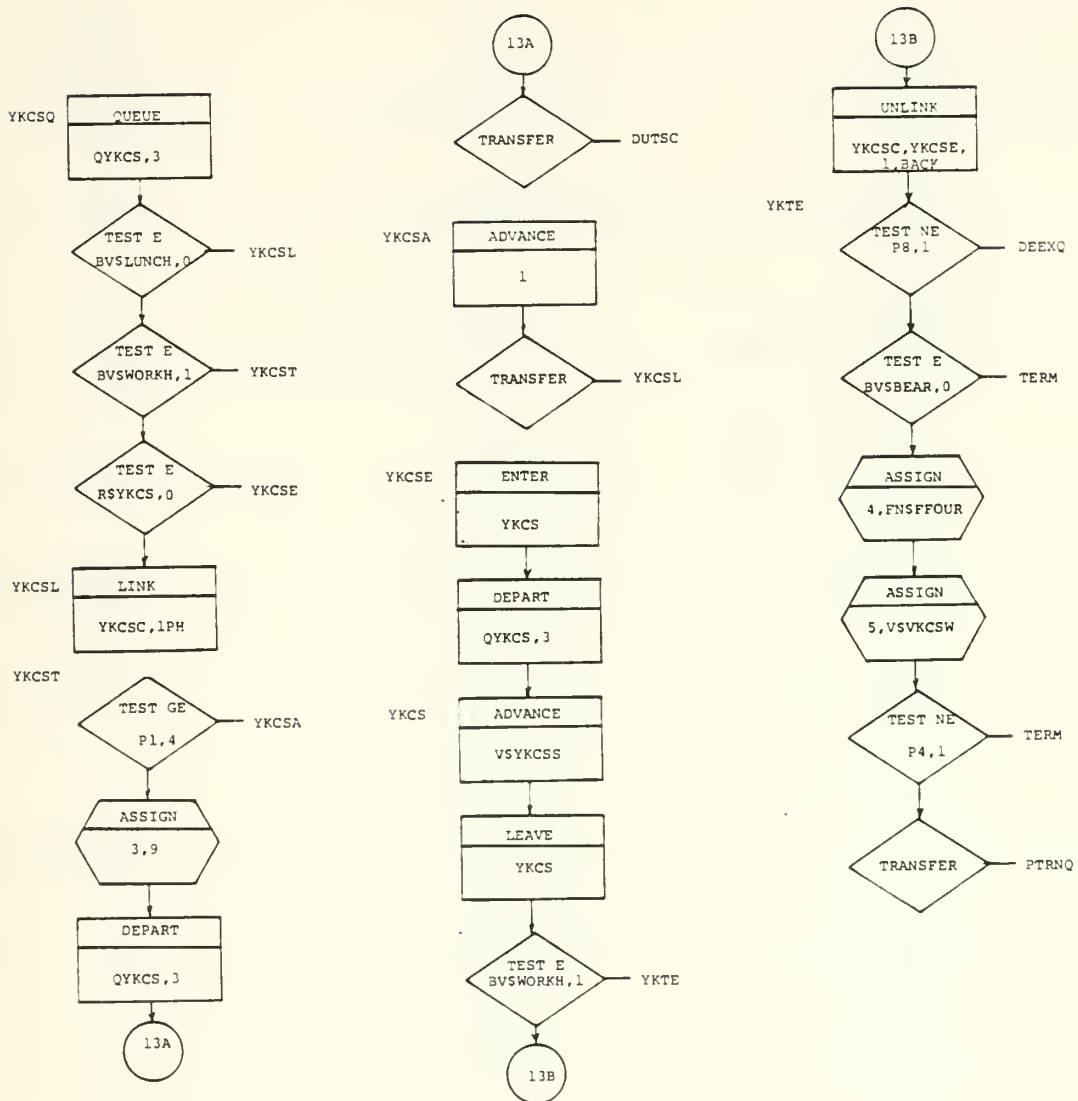


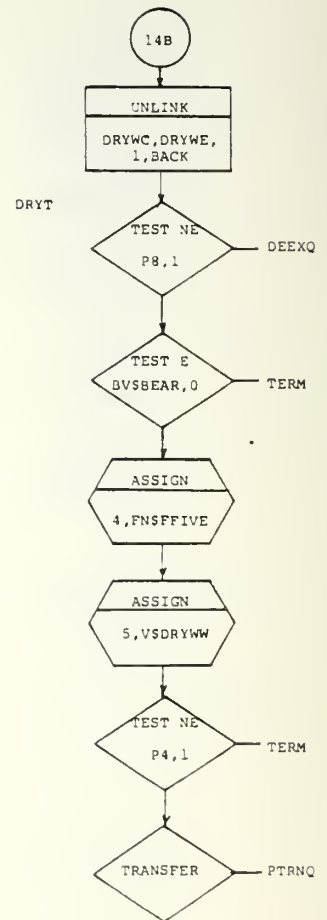
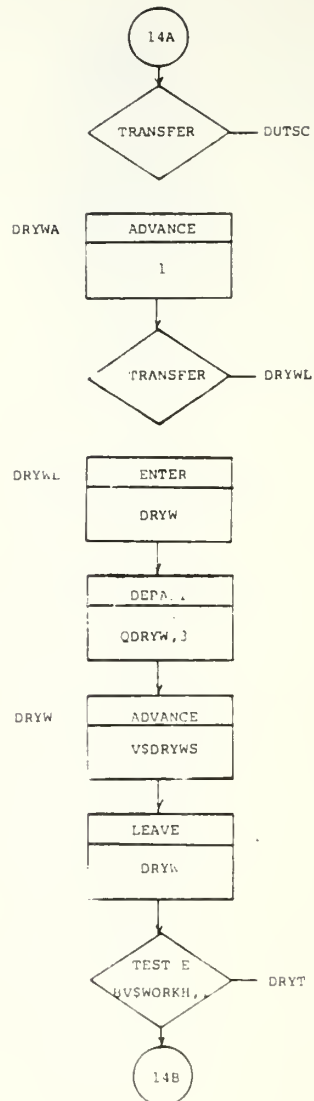
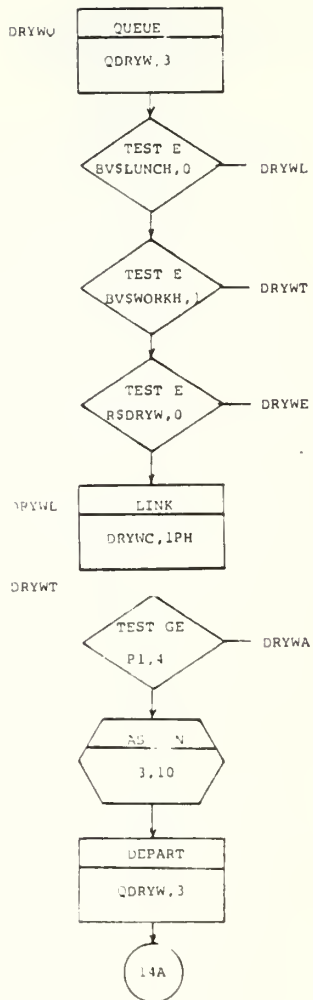


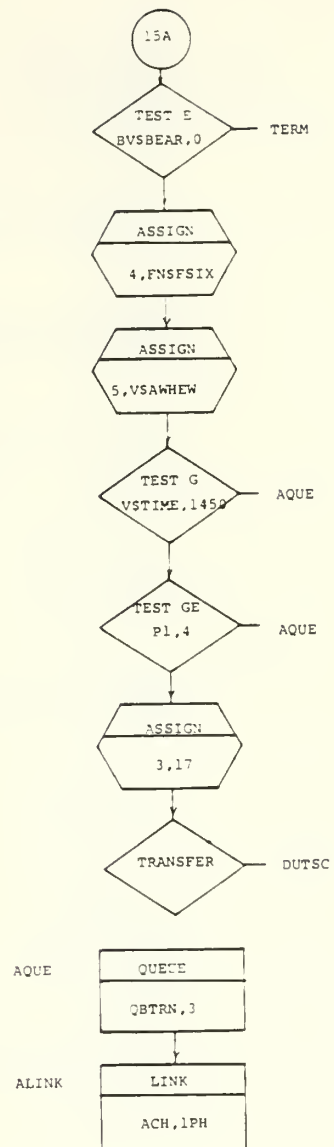
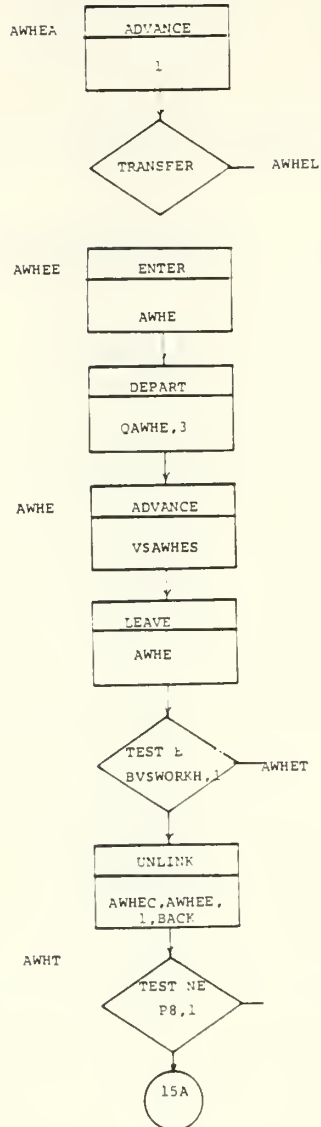
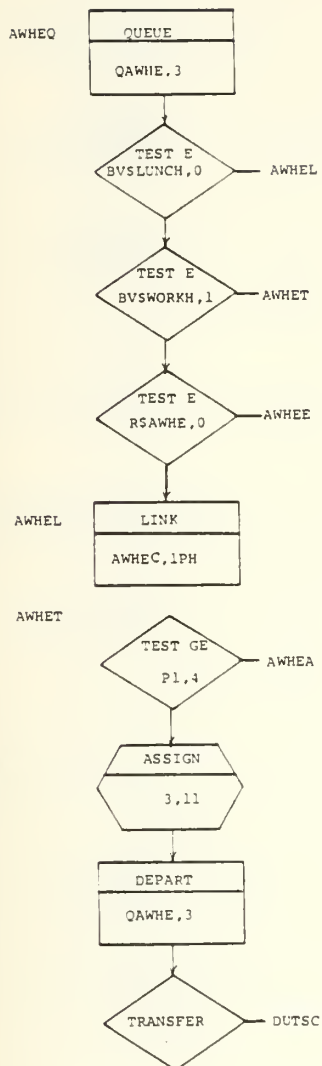


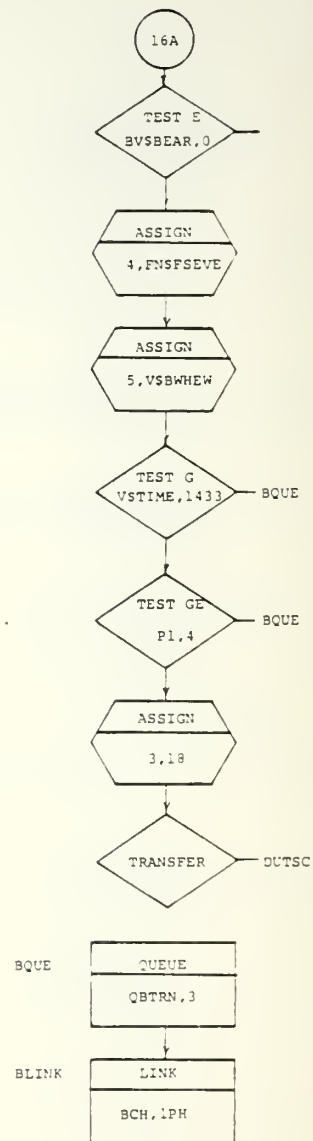
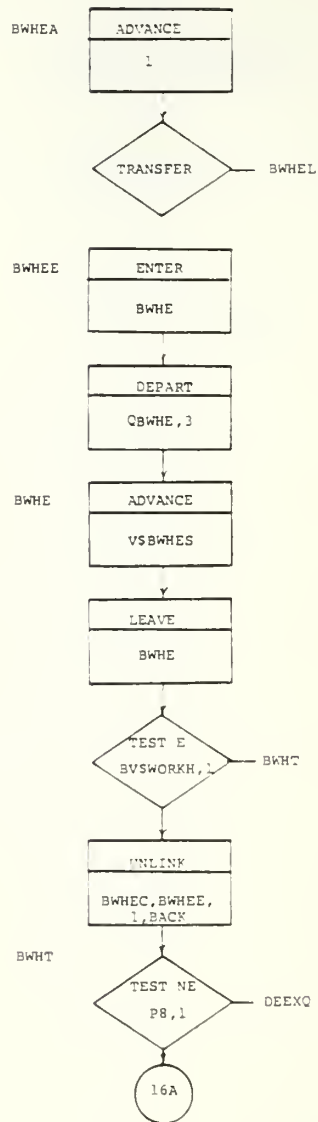
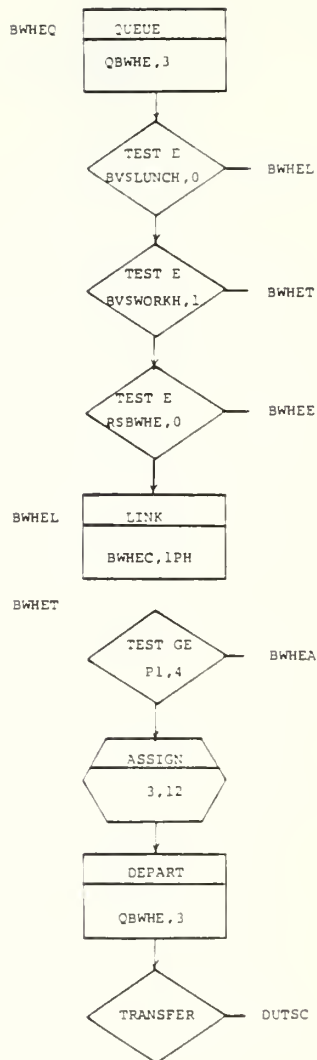


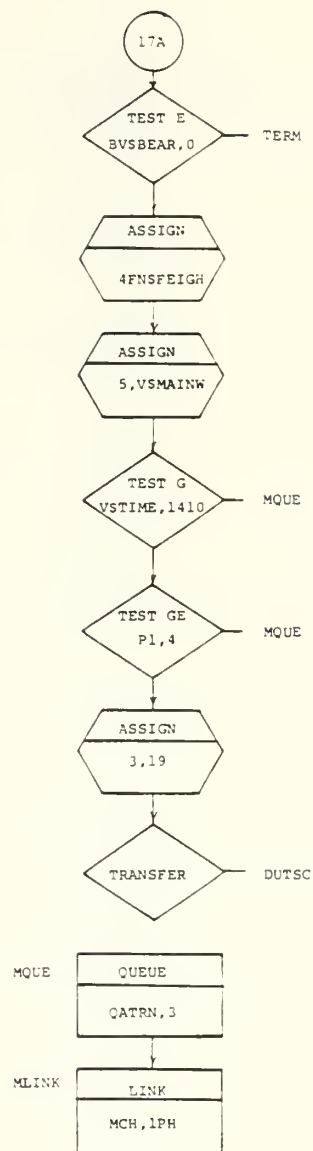
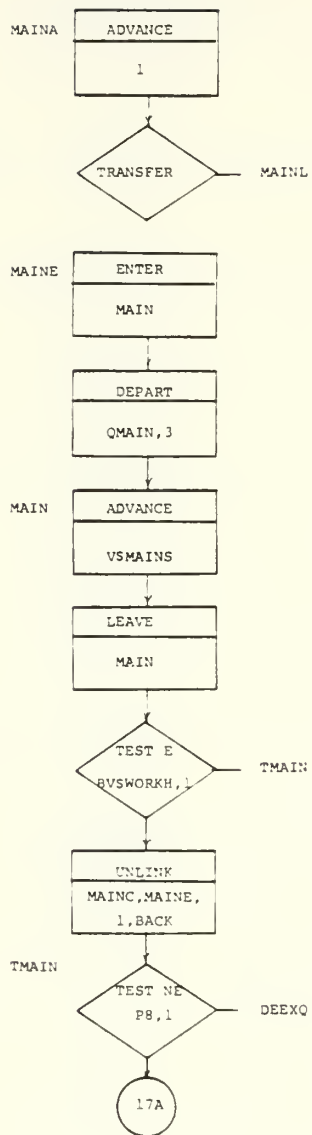
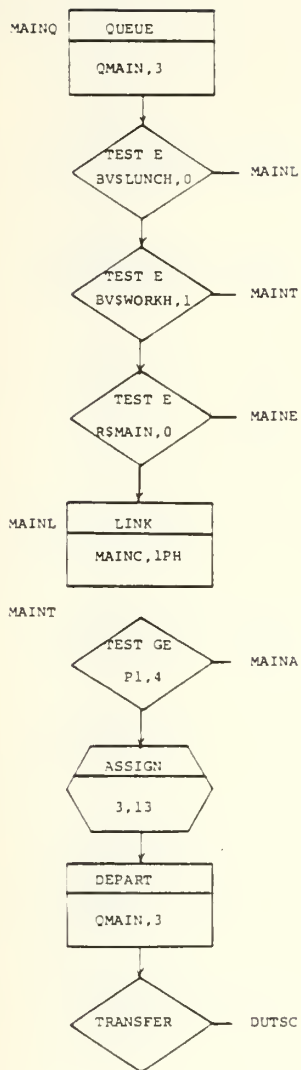


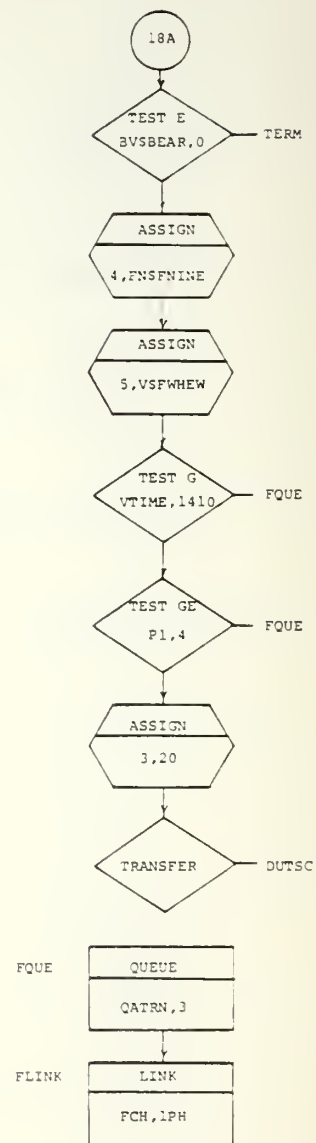
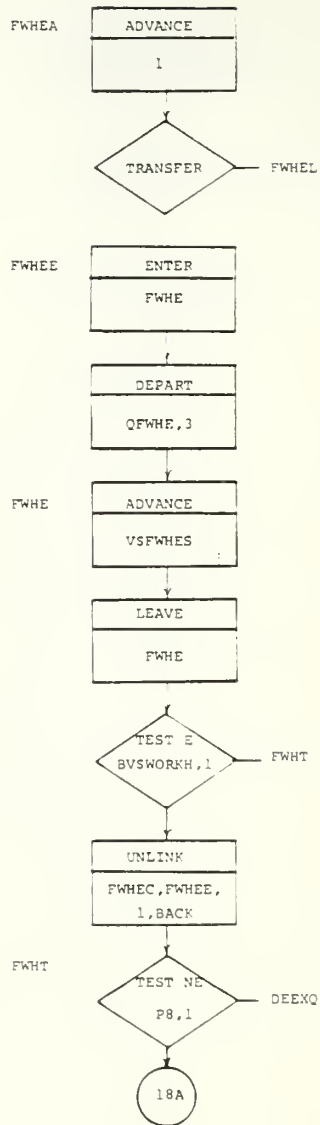
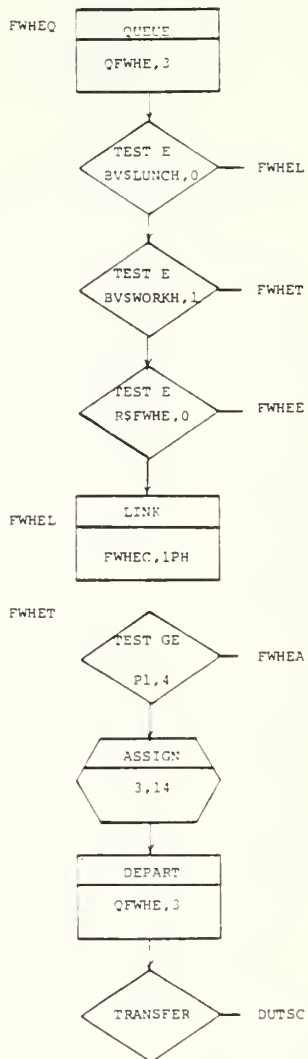


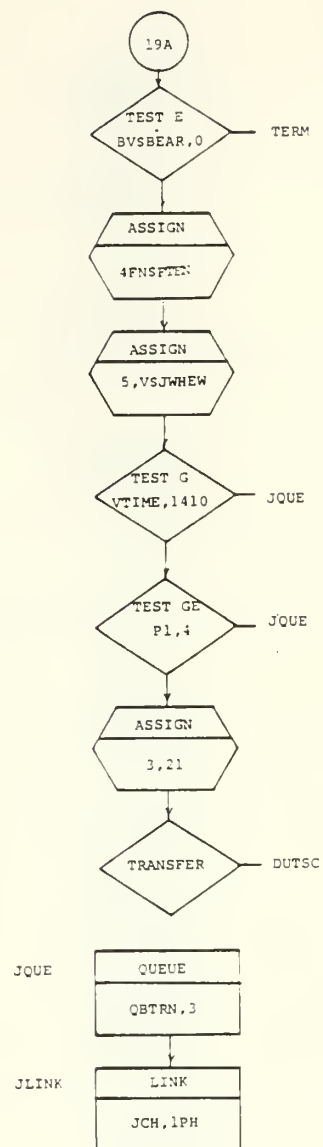
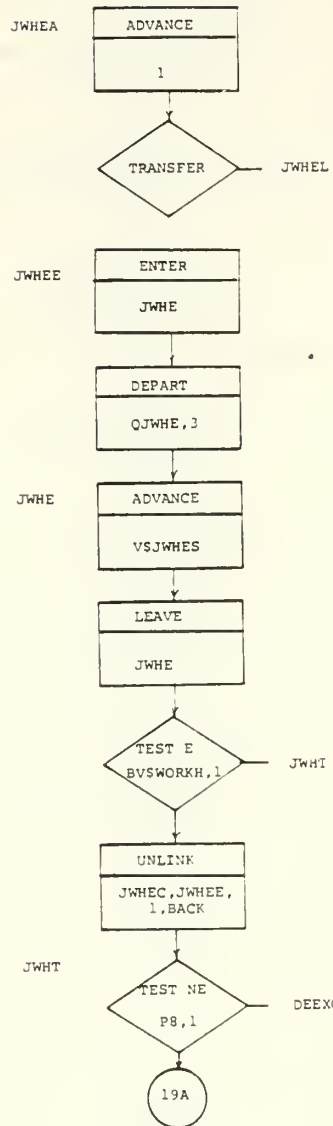
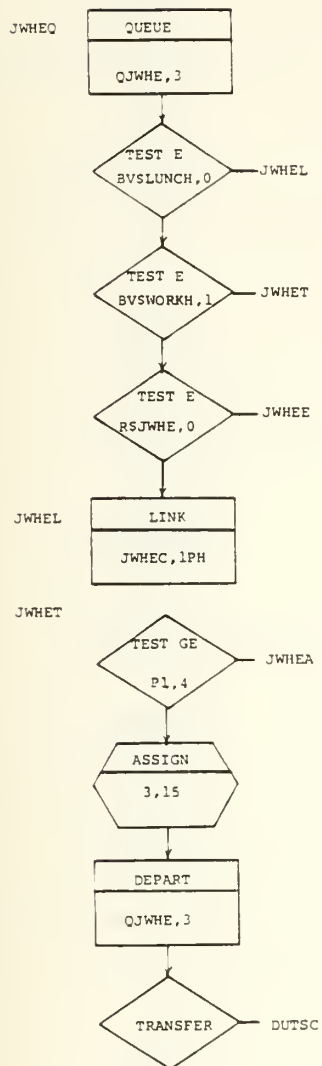


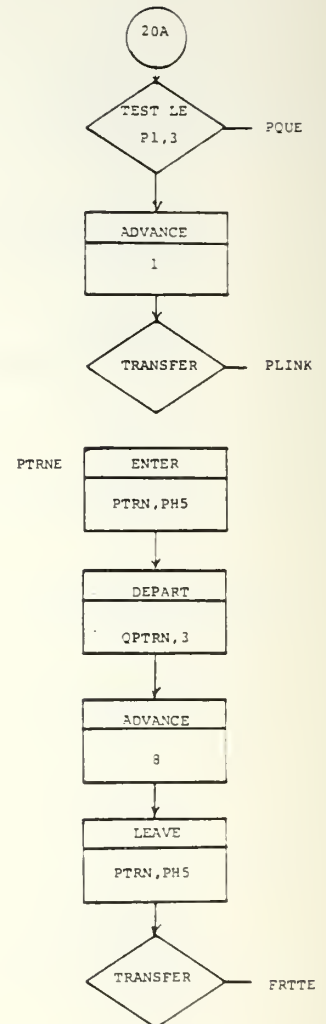
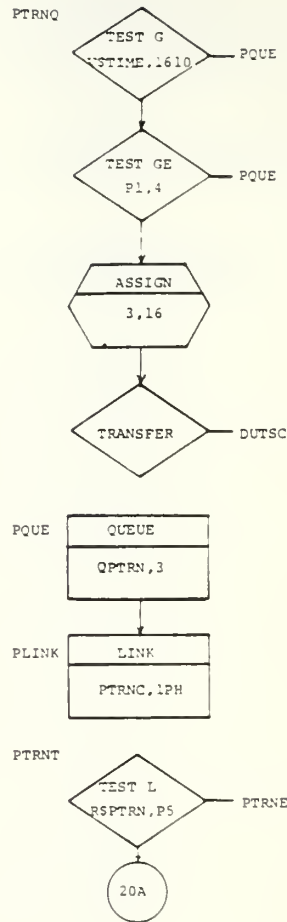
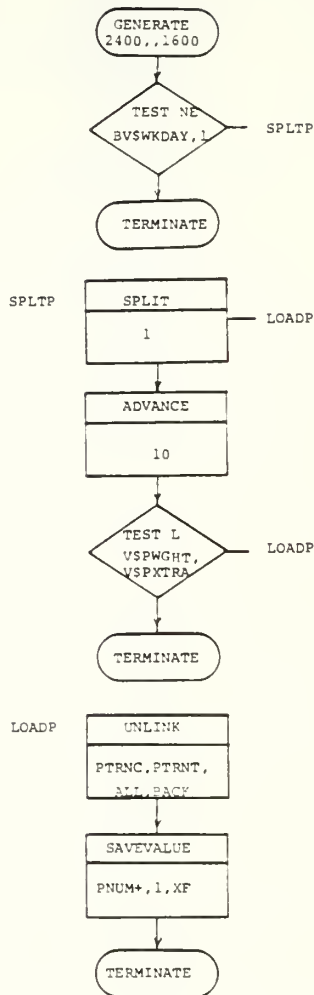


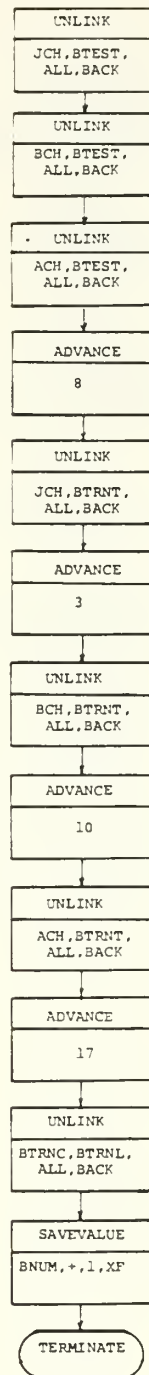
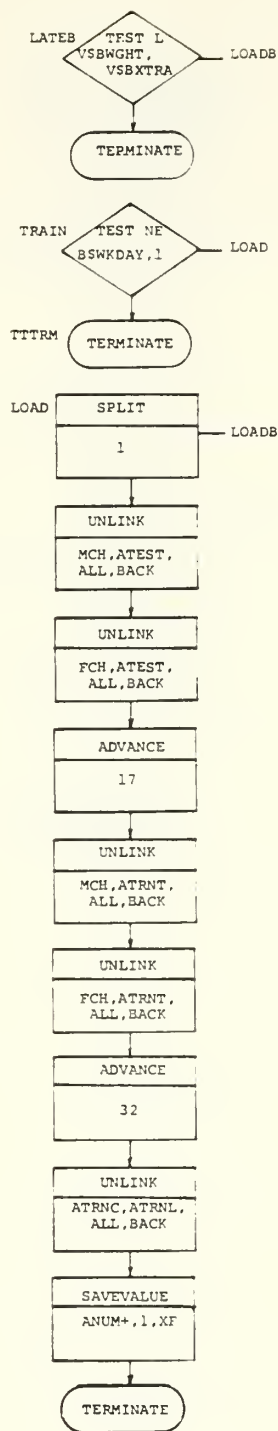
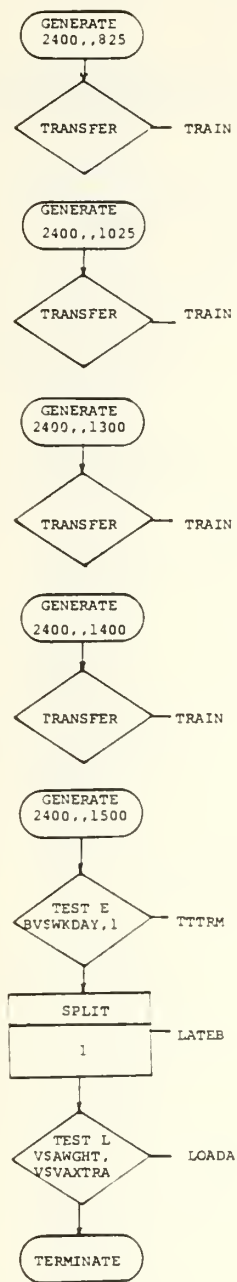


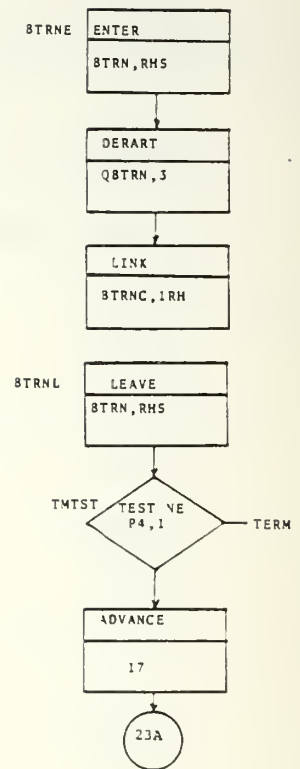
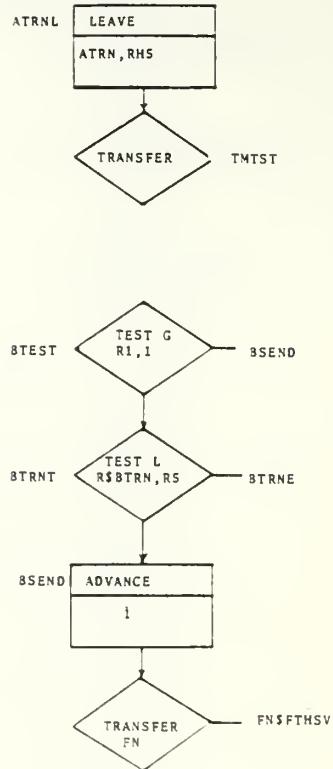
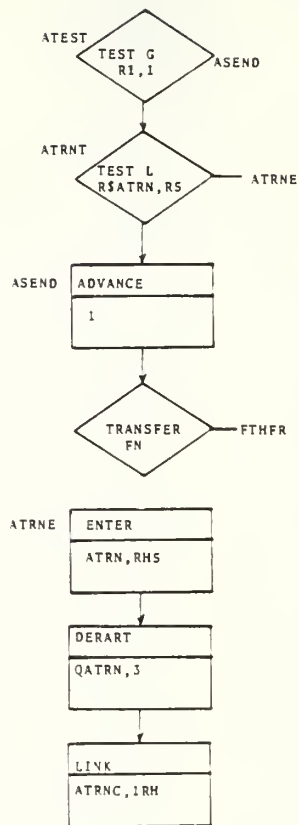


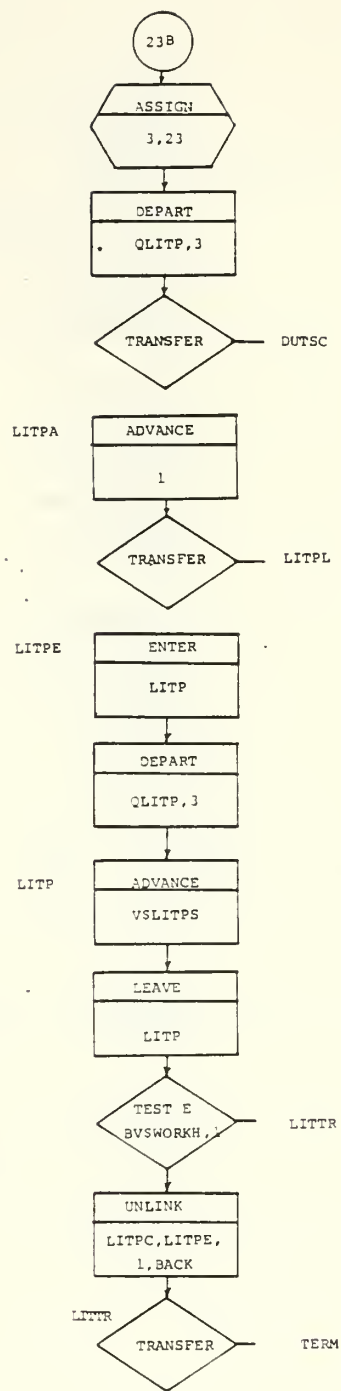
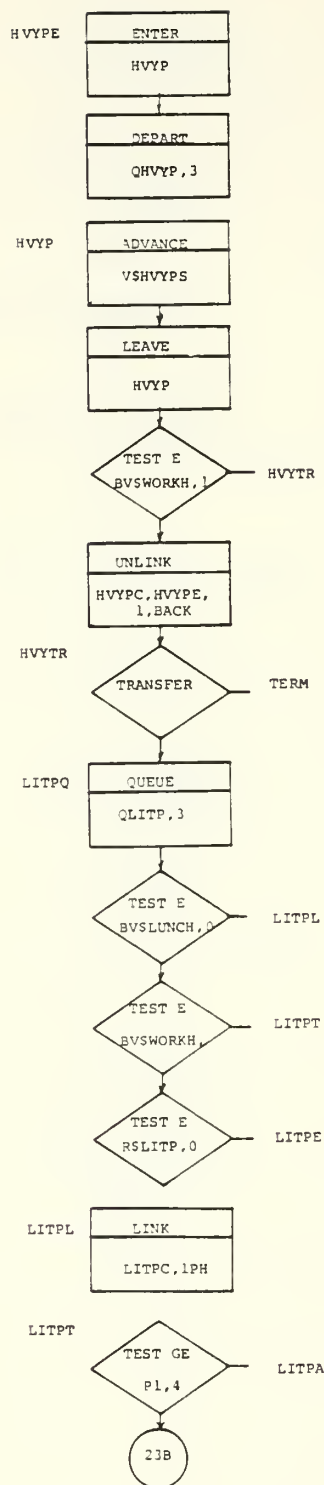
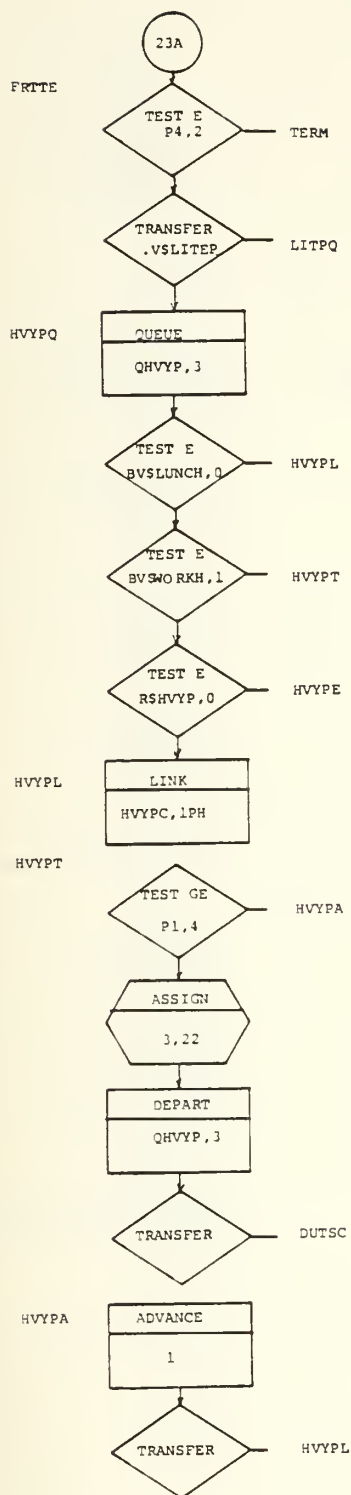


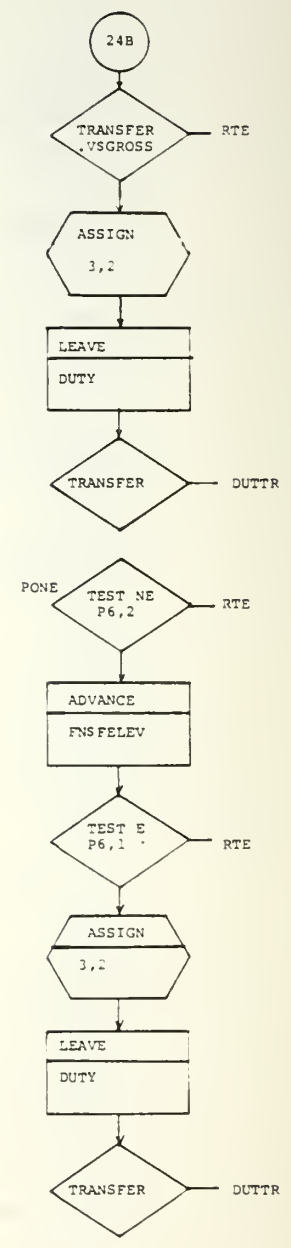
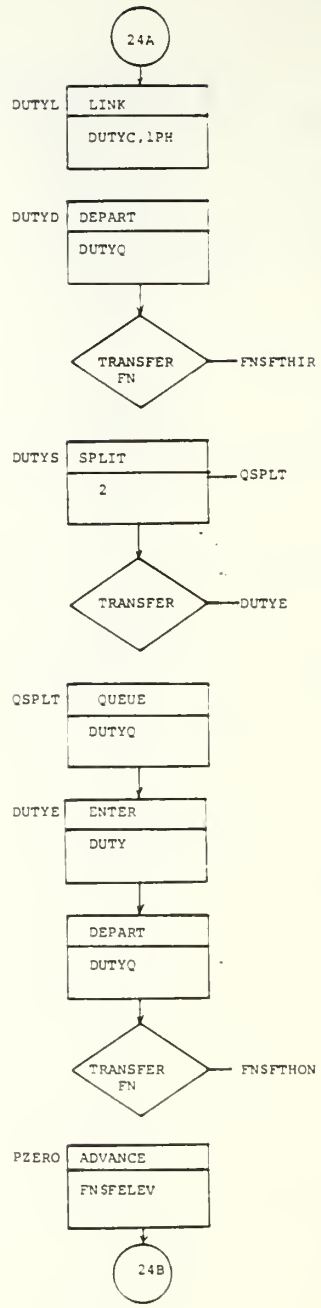
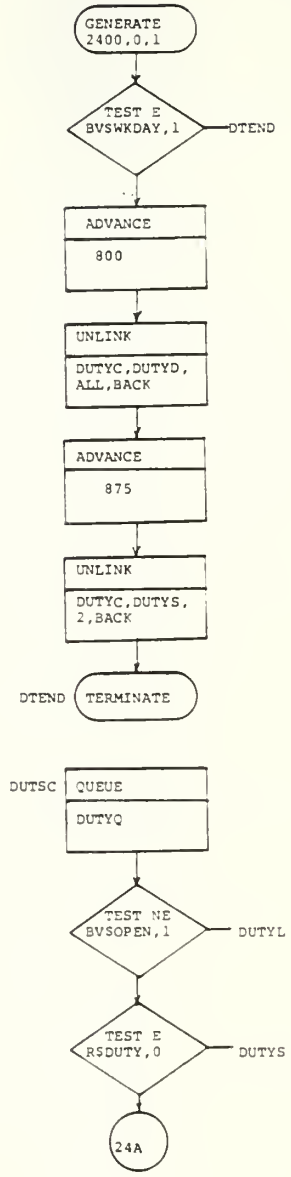


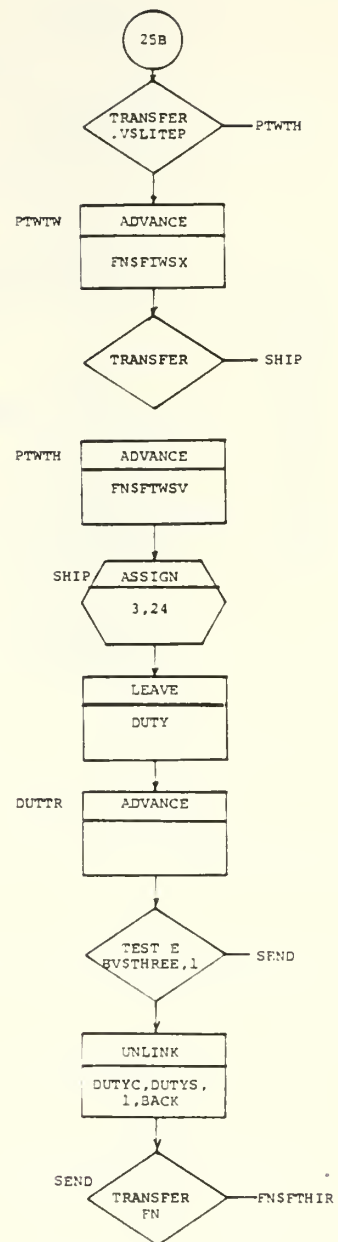
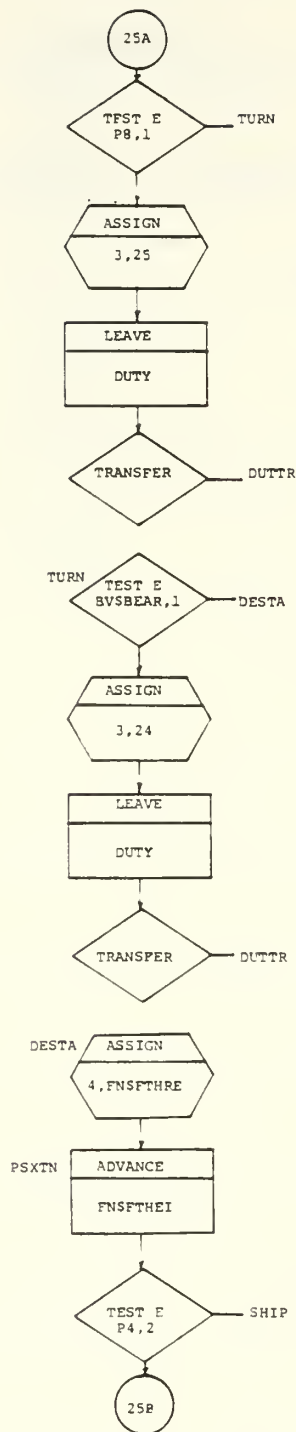
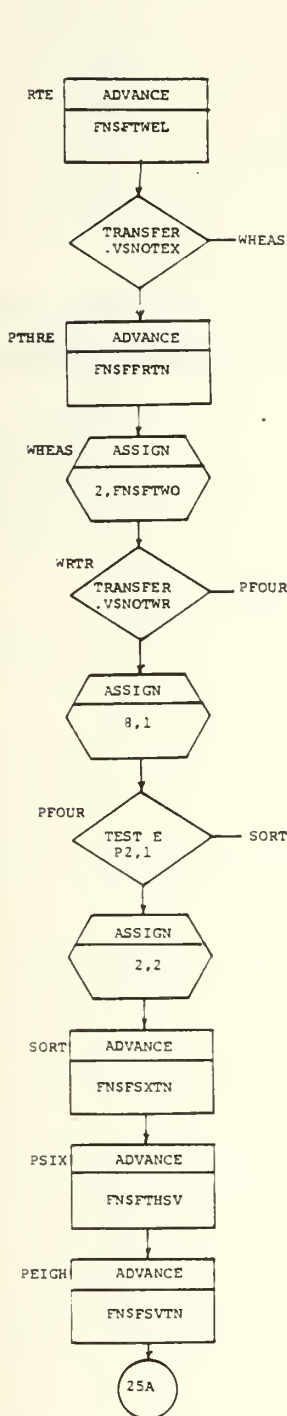


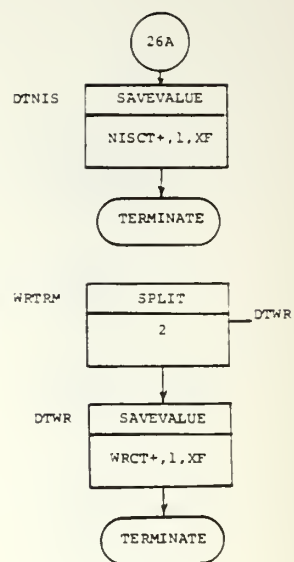
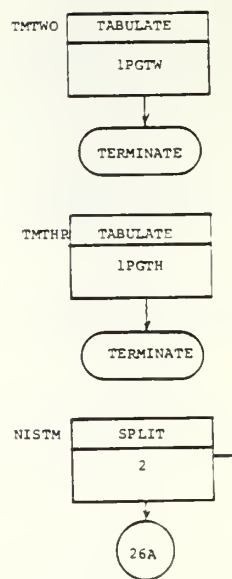
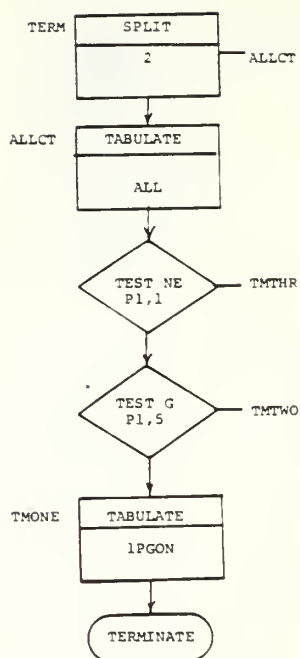












APPENDIX C
PROGRAM OUTPUT

TABLE OF CONTENTS

Block Counts	126
User Chains.	130
Storages	131
Queues	132
Tables	133
Savevalues	135

THIS IS SNAP				4 OF 4				67200 ABSOLUTE CLOCK				100800			
RELATIVE CLOCK				BLOCK COUNTS				BLOCK CURRENT				BLOCK CURRENT			
BLOCK	CURRENT	TOTAL	BLOCK	CURRENT	TOTAL	BLOCK	CURRENT	TOTAL	BLOCK	CURRENT	TOTAL	BLOCK	CURRENT	TOTAL	BLOCK
1	0	4	11	0	20	21	0	20	31	0	60	41	0	60	TOTAL
2	0	4	12	0	20	22	0	20	32	0	60	42	0	60	60
3	0	28	13	0	20	23	0	20	33	0	60	43	0	60	40
4	0	28	14	0	20	24	0	20	34	0	60	44	0	60	40
5	0	20	15	0	20	25	0	28	35	0	60	45	0	60	40
6	0	20	16	0	20	26	0	60	36	0	60	46	0	60	40
7	0	20	17	0	20	27	0	60	37	0	60	47	0	60	40
8	0	20	18	0	20	28	0	60	38	0	60	48	0	60	40
9	0	20	19	0	20	29	0	60	39	0	60	49	0	60	40
10	0	20	20	0	20	30	0	60	40	0	60	50	0	60	40
BLOCK	CURRENT	TOTAL	BLOCK	CURRENT	TOTAL	BLOCK	CURRENT	TOTAL	BLOCK	CURRENT	TOTAL	BLOCK	CURRENT	TOTAL	BLOCK
51	0	40	61	0	20	71	0	20	81	0	40	91	0	40	TOTAL
52	0	40	62	0	20	72	0	20	82	0	40	92	0	40	40
53	0	40	63	0	20	73	0	20	83	0	40	93	0	28	28
54	0	40	64	0	20	74	0	20	84	0	40	94	0	28	28
55	0	40	65	0	20	75	0	20	85	0	40	95	0	704	704
56	0	40	66	0	20	76	0	40	86	0	40	96	0	704	704
57	0	40	67	0	20	77	0	40	87	0	40	97	0	704	704
58	0	40	68	0	20	78	0	40	88	0	40	98	0	28	28
59	0	40	69	0	20	79	0	40	89	0	40	99	0	28	28
60	0	20	70	0	20	80	0	40	90	0	40	100	0	10904	10904
BLOCK	CURRENT	TOTAL	BLOCK	CURRENT	TOTAL	BLOCK	CURRENT	TOTAL	BLOCK	CURRENT	TOTAL	BLOCK	CURRENT	TOTAL	BLOCK
101	0	10904	111	0	1012	121	0	173	131	0	8800	141	0	672	TOTAL
102	0	10904	112	0	1012	122	0	173	132	0	13260	142	0	461	461
103	0	28	113	0	44	123	0	173	133	0	7322	143	0	10	10
104	0	28	114	0	13260	124	0	173	134	0	4815	144	0	10	10
105	0	640	115	0	13260	125	0	4287	135	0	1646	145	0	10	10
106	0	640	116	0	13260	126	0	4287	136	0	1646	146	0	451	451
107	0	640	117	0	13260	127	0	4287	137	0	2507	147	0	451	451
108	0	28	118	0	13260	128	0	4287	138	0	2507	148	0	2489	2489
109	0	28	119	0	13260	129	0	8800	139	0	2315	149	0	2489	2489
110	0	1012	120	0	4460	130	0	8800	140	0	1854	150	0	2489	2489

BLOCK	CURRENT	TOTAL	BLOCK	CURRENT	TOTAL	BLOCK	CURRENT	TOTAL	BLOCK	CURRENT	TOTAL	BLOCK	CURRENT	TOTAL
151	0	2489	161	0	1746	171	0	1766	181	0	4655	191	0	9277
152	0	2489	162	0	98	172	0	1766	182	0	4655	192	0	2688
153	0	2470	163	0	31	173	0	1766	183	0	4655	193	0	2688
154	0	2489	164	0	24	174	0	1752	184	0	4655	194	0	2688
155	0	1627	165	0	24	175	0	1766	185	0	4655	195	0	2688
156	0	1627	166	0	24	176	0	41	186	0	4624	196	0	13440
157	0	4815	167	0	7	177	0	4652	187	0	4655	197	0	13440
158	0	1790	168	0	7	178	0	4652	188	0	1593	198	0	13440
159	0	1790	169	0	1766	179	0	3532	189	0	5938	199	0	6931
160	0	1777	170	0	1766	180	0	2053	190	0	9574	200	0	6931

BLOCK	CURRENT	TOTAL	BLOCK	CURRENT	TOTAL	BLOCK	CURRENT	TOTAL	BLOCK	CURRENT	TOTAL	BLOCK	CURRENT	TOTAL
201	0	4772	211	0	2642	221	0	523	231	0	906	241	0	8574
202	0	2159	212	0	2642	222	0	1	232	0	906	242	0	8571
203	0	6946	213	0	2642	223	0	1	233	0	906	243	0	5953
204	0	6946	214	0	9588	224	0	1	234	0	904	244	1	135
205	0	6946	215	0	8703	225	0	1	235	0	906	245	0	134
206	0	6946	216	0	905	226	0	522	236	0	23	246	0	5953
207	0	6946	217	0	905	227	0	522	237	0	8706	247	0	5953
208	0	2643	218	0	854	228	0	906	238	0	8706	248	0	5584
209	0	2643	219	0	331	229	0	906	239	0	25	249	0	2111
210	0	2642	220	0	615	230	0	906	240	0	8706	250	0	4886

BLOCK	CURRENT	TOTAL	BLOCK	CURRENT	TOTAL	BLOCK	CURRENT	TOTAL	BLOCK	CURRENT	TOTAL	BLOCK	CURRENT	TOTAL
251	0	3473	261	0	5940	271	0	4	281	0	2619	291	0	1
252	0	10	262	0	5924	272	0	4	282	0	1445	292	0	1431
253	0	10	263	0	5940	273	0	1546	283	0	28	293	0	1431
254	0	10	264	0	2618	274	0	1546	284	0	28	294	0	1426
255	0	3463	265	0	2618	275	0	2619	285	0	28	295	0	1426
256	0	3463	266	0	2461	276	0	2619	286	0	1445	296	0	1426
257	0	5940	267	0	913	277	0	2619	287	0	14	297	0	1426
258	0	5940	268	0	2337	278	0	2619	288	0	13	298	0	1426
259	0	5940	269	0	1550	279	0	2619	289	0	13	299	0	2688
260	0	5940	270	0	4	280	0	2611	290	0	1	300	0	2688

BLOCK	CURRENT	TOTAL	BLOCK	CURRENT	TOTAL	BLOCK	CURRENT	TOTAL	BLOCK	CURRENT	TOTAL	BLOCK	CURRENT	TOTAL
301	0	2688	311	0	2	321	0	1451	331	0	1453	341	0	232
302	0	7114	312	0	7092	322	0	1206	332	0	1453	342	0	2
303	0	7114	313	0	7100	323	0	9	333	0	1453	343	0	2
304	0	84	314	0	7100	324	0	9	334	0	1262	344	0	2
305	0	22	315	0	7100	325	0	9	335	0	1453	345	0	2
306	0	20	316	0	7100	326	0	9	336	0	1451	346	0	0
307	0	20	317	0	7120	327	0	0	337	0	508	347	0	0
308	0	20	318	0	1462	328	0	0	338	0	508	348	0	506
309	0	2	319	0	1462	329	0	1453	339	0	508	349	0	506
310	0	2	320	0	1460	330	0	1453	340	0	506	350	0	506

BLOCK	CURRENT	TOTAL	BLOCK	CURRENT	TOTAL	BLOCK	CURRENT	TOTAL	BLOCK	CURRENT	TOTAL	BLOCK	CURRENT	TOTAL	BLOCK	CURRENT	TOTAL
351	0	506	361	0	682	371	0	679	381	0	665	391	0	0	401	0	4123
352	0	506	362	0	681	372	0	679	382	0	253	392	0	16	402	0	83
353	0	417	363	0	678	373	0	679	383	0	446	393	0	16	403	0	6
354	0	506	364	0	537	374	0	679	384	0	446	394	0	446	404	0	6
355	0	505	365	0	3	375	0	679	385	0	446	395	0	446	405	0	6
356	0	497	366	0	3	376	0	641	386	0	446	396	0	446	406	0	77
357	0	497	367	0	3	377	0	679	387	0	389	397	0	446	407	0	77
358	0	497	368	0	3	378	0	677	388	0	16	398	0	446	408	0	4308
359	0	36	369	0	0	379	0	665	389	0	0	399	0	391	409	0	4308
360	0	682	370	0	0	380	0	665	390	0	0	400	0	446	410	0	4308
BLOCK	CURRENT	TOTAL	BLOCK	CURRENT	TOTAL	BLOCK	CURRENT	TOTAL	BLOCK	CURRENT	TOTAL	BLOCK	CURRENT	TOTAL	BLOCK	CURRENT	TOTAL
401	0	445	411	0	410	421	0	410	431	0	402	441	0	4123	451	0	470
402	0	437	412	0	410	422	0	410	432	0	78	442	0	83	452	0	470
403	0	437	413	0	410	423	0	410	433	0	5	443	0	6	453	0	469
404	0	437	414	0	267	424	0	410	434	0	5	444	0	6	454	0	468
405	0	129	415	0	0	425	0	410	435	0	397	445	0	6	455	0	234
406	0	2	416	0	0	426	0	384	436	0	1137	446	0	77	456	0	1
407	0	2	417	0	0	427	0	410	437	0	4314	447	0	77	457	0	1
408	0	435	418	0	0	428	0	408	438	0	4314	448	0	4308	458	0	1
409	0	7251	419	0	0	429	0	402	439	0	4313	449	0	4308	459	0	1
410	0	410	420	0	0	430	0	402	440	0	4307	450	0	4308	460	0	0
BLOCK	CURRENT	TOTAL	BLOCK	CURRENT	TOTAL	BLOCK	CURRENT	TOTAL	BLOCK	CURRENT	TOTAL	BLOCK	CURRENT	TOTAL	BLOCK	CURRENT	TOTAL
451	0	4308	461	0	26	471	0	0	481	0	401	491	0	470	501	0	290
452	0	4308	462	0	4202	472	0	0	482	0	399	492	0	470	502	0	290
453	0	4100	463	0	7105	473	0	0	483	0	392	493	0	469	503	0	28
454	0	4308	464	0	401	474	0	0	484	0	392	494	0	468	504	0	28
455	0	4296	465	0	401	475	0	401	485	0	392	495	0	234	505	0	28
456	0	4228	466	0	401	476	0	401	486	0	50	496	0	1	506	0	28
457	0	4228	467	0	401	477	0	401	487	0	2	497	0	1	507	0	28
458	0	4228	468	0	328	478	0	401	488	0	2	498	0	1	508	0	28
459	0	1355	469	0	0	479	0	401	489	0	390	499	0	1	509	0	28
460	0	26	470	0	0	480	0	389	490	0	2154	500	0	0	510	0	28
BLOCK	CURRENT	TOTAL	BLOCK	CURRENT	TOTAL	BLOCK	CURRENT	TOTAL	BLOCK	CURRENT	TOTAL	BLOCK	CURRENT	TOTAL	BLOCK	CURRENT	TOTAL
501	0	0	511	0	455	521	0	40	531	0	0	541	0	290	551	0	28
502	0	469	512	0	455	522	0	20	532	0	289	542	0	290	552	0	28
503	0	469	513	0	118	523	0	20	533	0	289	543	0	28	553	0	28
504	0	469	514	0	3	524	0	20	534	0	290	544	0	28	554	0	28
505	0	469	515	0	3	525	0	20	535	0	0	545	0	28	555	0	28
506	0	469	516	0	452	526	0	20	536	0	0	546	0	28	556	0	28
507	0	397	517	0	943	527	0	20	537	0	0	547	0	28	557	0	28
508	0	469	518	0	28	528	0	289	538	0	290	548	0	28	558	0	28
509	0	468	519	0	28	529	0	5	539	0	290	549	0	28	559	0	28
510	0	455	520	0	8	530	0	0	540	0	290	550	0	28	560	0	28

BLOCK	TOTAL	BLOCK	TOTAL	BLOCK	TOTAL	BLOCK	TOTAL	BLOCK	TOTAL	BLOCK	TOTAL	BLOCK	TOTAL	BLOCK	TOTAL	BLOCK	TOTAL
CURRENT		CURRENT		CURRENT		CURRENT		CURRENT		CURRENT		CURRENT		CURRENT		CURRENT	
551	0	561	0	571	0	581	0	591	0	601	0	611	0	621	0	631	0
552	0	562	0	572	0	582	0	592	0	602	0	612	0	572	0	632	0
553	0	563	0	573	0	583	0	593	0	603	0	613	0	583	0	633	0
554	0	564	0	574	0	584	0	594	0	604	0	614	0	584	0	634	0
555	0	565	0	575	0	585	0	595	0	605	0	615	0	585	0	635	0
556	0	566	0	576	0	586	0	596	0	606	0	616	0	586	0	636	0
557	0	567	0	577	0	587	0	597	0	607	0	617	0	587	0	637	0
558	0	568	0	578	0	588	0	598	0	608	0	618	0	588	0	638	0
559	0	569	0	579	0	589	0	599	0	609	0	619	0	589	0	639	0
560	0	570	0	580	0	590	0	600	0	610	0	620	0	590	0	640	0
TOTAL	28	TOTAL	81	TOTAL	97	TOTAL	97	TOTAL	97	TOTAL	97	TOTAL	97	TOTAL	97	TOTAL	97
601	0	611	0	621	0	631	0	641	0	651	0	661	0	671	0	681	0
602	0	612	0	622	0	632	0	642	0	652	0	662	0	672	0	682	0
603	0	613	0	623	0	633	0	643	0	653	0	663	0	673	0	683	0
604	0	614	0	624	0	634	0	644	0	654	0	664	0	674	0	684	0
605	0	615	0	625	0	635	0	645	0	655	0	665	0	675	0	685	0
606	0	616	0	626	0	636	0	646	0	656	0	666	0	676	0	686	0
607	0	617	0	627	0	637	0	647	0	657	0	667	0	677	0	687	0
608	0	618	0	628	0	638	0	648	0	658	0	668	0	678	0	688	0
609	0	619	0	629	0	639	0	649	0	659	0	669	0	679	0	689	0
610	0	620	0	630	0	640	0	650	0	660	0	670	0	680	0	690	0
TOTAL	5478	TOTAL	0	TOTAL	337	TOTAL	337	TOTAL	337	TOTAL	337	TOTAL	337	TOTAL	337	TOTAL	337
651	0	661	0	671	0	681	0	691	0	701	0	711	0	721	0	731	0
652	0	662	0	672	0	682	0	692	0	702	0	712	0	722	0	732	0
653	0	663	0	673	0	683	0	693	0	703	0	713	0	723	0	733	0
654	0	664	0	674	0	684	0	694	0	704	0	714	0	724	0	734	0
655	0	665	0	675	0	685	0	695	0	705	0	715	0	725	0	735	0
656	0	666	0	676	0	686	0	696	0	706	0	716	0	726	0	736	0
657	0	667	0	677	0	687	0	697	0	707	0	717	0	727	0	737	0
658	0	668	0	678	0	688	0	698	0	708	0	718	0	728	0	738	0
659	0	669	0	679	0	689	0	699	0	709	0	719	0	729	0	739	0
660	0	670	0	680	0	690	0	700	0	710	0	720	0	730	0	740	0
TOTAL	333	TOTAL	10	TOTAL	56	TOTAL	56	TOTAL	56	TOTAL	56	TOTAL	56	TOTAL	56	TOTAL	56
701	0	711	0	721	0	731	0	741	0	751	0	761	0	771	0	781	0
702	0	712	0	722	0	732	0	742	0	752	0	762	0	772	0	782	0
703	0	713	0	723	0	733	0	743	0	753	0	763	0	773	0	783	0
704	0	714	0	724	0	734	0	744	0	754	0	764	0	774	0	784	0
705	0	715	0	725	0	735	0	745	0	755	0	765	0	775	0	785	0
706	0	716	0	726	0	736	0	746	0	756	0	766	0	776	0	786	0
707	0	717	0	727	0	737	0	747	0	757	0	767	0	777	0	787	0
708	0	718	0	728	0	738	0	748	0	758	0	768	0	778	0	788	0
709	0	719	0	729	0	739	0	749	0	759	0	769	0	779	0	789	0
710	0	720	0	730	0	740	0	750	0	760	0	770	0	780	0	790	0
TOTAL	333	TOTAL	17157	TOTAL	17157	TOTAL	17157	TOTAL	17157	TOTAL	17157	TOTAL	17157	TOTAL	17157	TOTAL	17157

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USER CHAINS

USER CHAIN	TOTAL ENTRIES	AVERAGE TIME/TRANS	CURRENT CONTENTS	AVERAGE CONTENTS	MAXIMUM CONTENTS
MAINC	4123	206.674		12.680	153
FCH	2162	267.294	3	8.599	31
ACH	7279	350.811	46	37.999	65
BCH	1138	200.007	3	3.387	15
JCH	945	267.903	3	3.767	16
PTRNC	290	442.155		1.908	20
SKCKC	724	1507.440	60	16.240	71
CRTEC	98	287.285		.418	5
DEEXC	618	75.906	1	.698	41
SCNTC	4899	111.655	16	8.139	231
STOFC	2346	149.248	4	5.210	105
YHCSC	1206	126.582		2.271	63
YKCSC	232	87.969		.303	14
DRYWC	537	84.059		.671	24
AMHEC	389	234.964		1.360	18
FIHEC	267	66.715		.265	12
FIHEC	328	80.234		.391	15
JMHEC	234	80.670		.280	11
HVYPC	228	430.140	1	1.459	10
LITPC	4093	409.713	12	24.954	106
DRTEC	2148	884.417	92	28.269	119
THREE	5039	2850.916	261	213.776	302
THO	2199	735.309	31	24.061	52
ONE	2643	2.065	1	.081	9
DLVRC	1496	2609.096	70	.58.083	91
BIKEC	7109	176.599	9	18.682	200
HCH	7178	562.773	97	60.112	102
ATRNC	4573	37.174		2.529	81
BYRNC	1263	28.735		.540	17
DUTYC	43	121.534		.077	6

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STORAGES

STORAGE	CAPACITY	AVERAGE CONTENTS	ENTRIES	AVERAGE TIME/UNIT	-AVERAGE TOTAL TIME	UTILIZATION DURING- AVAIL. UNAVAIL. TIME	CURRENT STATUS	PERCENT AVAILABILITY	CURRENT CONTENTS	MAXIMUM CONTENTS
SKCK	6	.111	2489	2.994	.018	.077	NA	23.8		6
CRTE	5	.081	1766	3.087	.016	.068	NA	23.8		5
DRTE	2	.208	4655	3.001	.103	.434	NA	23.8		2
DEEX	2	.044	906	3.262	.021	.092	NA	23.8		2
SCPR	100000	.000	6946	.000	.000			100.0		1
CSPR	100000	.000	2642	.000	.000			100.0		1
SCNT	4	.269	5940	3.044	.067	.282	NA	23.8		4
STOF	1	.117	2619	2.998	.116	.490	NA	23.8		1
DLVR	100000	3.175	1426	149.621	.000			100.0		91
YHCS	11	1.118	1453	51.714	.101	.388	NA	23.8		11
YKCS	4	.391	506	51.974	.097	.366	NA	23.8		4
DRYM	2	.214	679	21.227	.107	.434	NA	23.8		2
AMHE	2	.355	446	53.504	.177	.696	NA	23.8		2
BMHE	2	.174	410	28.451	.086	.355	NA	23.8		2
MAIN	8	1.535	4308	23.952	.191	.781	NA	23.8		8
FYHE	1	.096	401	16.035	.095	.396	NA	23.8		1
JHHE	4	.390	469	55.951	.097	.367	NA	23.8		4
ATRN	32000	1373.081	2493603	37.003	.042			100.0		31998
BTRN	32000	1324.309	3019653	29.471	.041			100.0		31986
PTRN	32000	37.344	313686	8.000	.001			100.0		22221
LITP	5	1.138	3660	20.899	.227	.925	NA	23.8		5
HVYP	3	.583	337	116.279	.194	.704	NA	23.8		3
DUTY	2	.082	333	16.462	.040			100.0		2
BIKE	100000	2.209	7100	20.912	.000			100.0		200

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QUEUES

QUEUE	MAXIMUM CONTENTS	AVERAGE CONTENTS	TOTAL ENTRIES	ZERO ENTRIES	PERCENT ZEROS	AVERAGE TIME/TRANS	AVERAGE TIME/TRANS	TABLE NUMBER	CURRENT CONTENTS
QSKCK	213	48.743	7677	5502	71.6	426.674	1506.013		180
QCRTE	18	1.259	5370	5136	95.6	15.755	361.563		276
QDRTE	357	84.814	14241	7791	54.7	400.220	883.650		876
QSCPR	1035	713.513	21714	12	.0	2208.166	2209.387		3
QSCPR	27	.243	7929	1479	18.6	2.065	2.539		3
QDEEX	123	2.117	2724	870	31.9	52.237	76.750		3
QSCNT	693	24.574	17898	3201	17.8	92.266	112.362		48
QSTOF	315	15.700	7881	849	10.7	133.872	150.034		12
QDLVR	273	174.250	4488	15	.3	2609.096	2617.845		210
QBIKE	600	56.046	21393	174	.8	176.054	177.498		27
QYHCS	189	6.917	4286	975	22.2	105.980	136.274		
QYKCS	42	.920	1524	828	54.3	40.606	88.913		
QDRYM	72	2.015	2046	435	21.2	66.187	84.059		
QAHHE	54	4.171	1338	219	16.3	209.488	250.487		
QBTRN	258	135.820	3945	42	1.0	2313.599	2338.495		156
QBHIE	36	.795	1230	429	34.8	43.446	66.715		
QHAIN	459	38.052	12942	1068	8.2	197.582	215.354		300
QATRN	357	206.345	14019		.0	989.117	989.117		
QFVHE	45	1.174	1203	219	18.2	65.628	80.234		
QJHIE	33	.851	1410	711	50.4	40.597	81.892		
QPTRN	60	5.724	870		.0	442.155	442.155		
QHYPY	30	4.383	1014	414	40.8	290.473	490.899		3
QLITP	318	74.889	11016	471	4.2	456.842	477.247		36
DUTYQ	8	.119	333	143	42.9	24.096	42.231		

\$AVERAGE TIME/TRANS = AVERAGE TIME/TRANS EXCLUDING ZERO ENTRIES

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TABLES

TABLE ALL ENTRIES IN TABLE 25985		MEAN ARGUMENT 4601.589		STANDARD DEVIATION 3488.000		SUM OF ARGUMENTS 119572384.000		NON-WEIGHTED	
UPPER LIMIT	OBSERVED FREQUENCY	PER CENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN			
0	0	.00	.0	100.0	-.000	-1.319			
1200	4201	16.16	16.1	83.8	.260	-.975			
2400	839	3.42	19.5	80.4	.521	-.631			
3600	10155	39.08	58.6	41.3	.782	-.287			
4800	525	2.02	60.6	39.3	1.043	.056			
6000	2538	9.76	70.4	29.5	1.303	.400			
7200	624	2.40	72.8	27.1	1.564	.744			
8400	2958	11.38	84.2	15.7	1.825	1.088			
9600	603	2.32	86.5	13.4	2.086	1.433			
10800	2274	8.75	95.3	4.6	2.347	1.777			
12000	189	.72	96.0	3.9	2.607	2.121			
13200	669	2.57	98.6	1.3	2.868	2.465			
14400	39	.15	98.7	1.2	3.129	2.809			
15600	159	.61	99.3	.6	3.390	3.153			
16800	15	.05	99.4	.5	3.650	3.497			
18000	96	.36	99.8	.1	3.911	3.841			
19200	3	.01	99.8	.1	4.172	4.185			
20400	9	.03	99.8	.1	4.433	4.529			
21600	3	.01	99.8	.1	4.694	4.873			
22800	18	.06	99.9	.0	4.954	5.217			
24000	0	.00	99.9	.0	5.215	5.561			
OVERFLOW	18	.06	100.0	.0					
AVERAGE VALUE OF OVERFLOW		25119.00							

TABLE IPGON ENTRIES IN TABLE 353		MEAN ARGUMENT 760.742		STANDARD DEVIATION 342.000		SUM OF ARGUMENTS 268542.000		NON-WEIGHTED	
UPPER LIMIT	OBSERVED FREQUENCY	PER CENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN			
0	0	.00	.0	100.0	-.000	-2.224			
1200	332	94.05	94.0	5.9	1.577	1.284			
2400	21	5.94	100.0	.0	3.154	4.793			
REMAINING FREQUENCIES ARE ALL ZERO									

TABLE IPGTH		MEAN ARGUMENT		STANDARD DEVIATION		SUM OF ARGUMENTS		NON-WEIGHTED	
ENTRIES IN TABLE		2720.000		2266.000		23052000.000			
UPPER	OBSERVED	PER CENT	CUMULATIVE	CUMULATIVE	MULTIPLE	DEVIATION			
LIMIT	FREQUENCY	OF TOTAL	PERCENTAGE	REMAINDER	OF MEAN	FROM MEAN			
0	0	.00	.0	100.0	-.000	-1.200			
1200	2918	34.43	34.4	65.5	.441	-.670			
2400	508	5.99	40.4	59.5	.882	-.141			
3600	3438	40.56	80.9	19.0	1.323	.388			
4800	102	1.20	82.1	17.8	1.764	.917			
6000	225	2.65	84.8	15.1	2.205	1.447			
7200	216	2.54	87.3	12.6	2.647	1.977			
8400	1041	12.28	99.6	.3	3.088	2.506			
9600	15	.17	99.8	.1	3.529	3.036			
10800	12	.14	100.0	.0	3.970	3.565			
REMAINING FREQUENCIES ARE ALL ZERO									

REMAINING FREQUENCIES ARE ALL ZERO

TABLE IPGTH		MEAN ARGUMENT		STANDARD DEVIATION		SUM OF ARGUMENTS		NON-WEIGHTED	
ENTRIES IN TABLE		5610.058		3580.000		96251840.000			
UPPER	OBSERVED	PER CENT	CUMULATIVE	CUMULATIVE	MULTIPLE	DEVIATION			
LIMIT	FREQUENCY	OF TOTAL	PERCENTAGE	REMAINDER	OF MEAN	FROM MEAN			
0	0	.00	.0	100.0	-.000	-1.567			
1200	951	5.54	5.5	94.4	.213	-1.231			
2400	360	2.09	7.6	92.3	.427	-.896			
3600	6717	39.15	46.7	53.2	.641	-.561			
4800	423	2.46	49.2	50.7	.855	-.226			
6000	2313	13.48	62.7	37.2	1.069	.108			
7200	408	2.37	65.1	34.8	1.283	.444			
8400	1917	11.17	76.2	23.7	1.497	.779			
9600	588	3.42	79.7	20.2	1.711	1.114			
10800	2262	13.18	92.9	7.0	1.925	1.449			
12000	189	1.10	94.0	5.9	2.139	1.784			
13200	669	3.89	97.9	2.0	2.352	2.120			
14400	39	.22	98.1	1.8	2.566	2.455			
15600	159	.92	99.0	.9	2.780	2.790			
16800	15	.08	99.1	.8	2.994	3.125			
18000	96	.55	99.7	.2	3.208	3.460			
19200	3	.01	99.7	.2	3.422	3.796			
20400	9	.05	99.7	.2	3.636	4.131			
21600	3	.01	99.7	.2	3.850	4.466			
22800	18	.10	99.8	.1	4.064	4.801			
24000	0	.00	99.8	.1	4.278	5.136			
OVERFLOW	18	.10	100.0	.0					
AVERAGE VALUE OF OVERFLOW		25119.00							

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*      FULLWORD SAVEVALUES
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NUMBER - CONTENTS	NUMBER - CONTENTS	NUMBER - CONTENTS	NUMBER - CONTENTS	NUMBER - CONTENTS
REQCT 39780	PRION 519	PRITH 12861	PRITH 26400	PNUM 20
BRUM 97	NISCT 13636	WRCT 69		ANUM 81
END				

***** TOTAL RUN TIME (INCLUDING ASSEMBLY) = 4.74 MINUTES *****

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